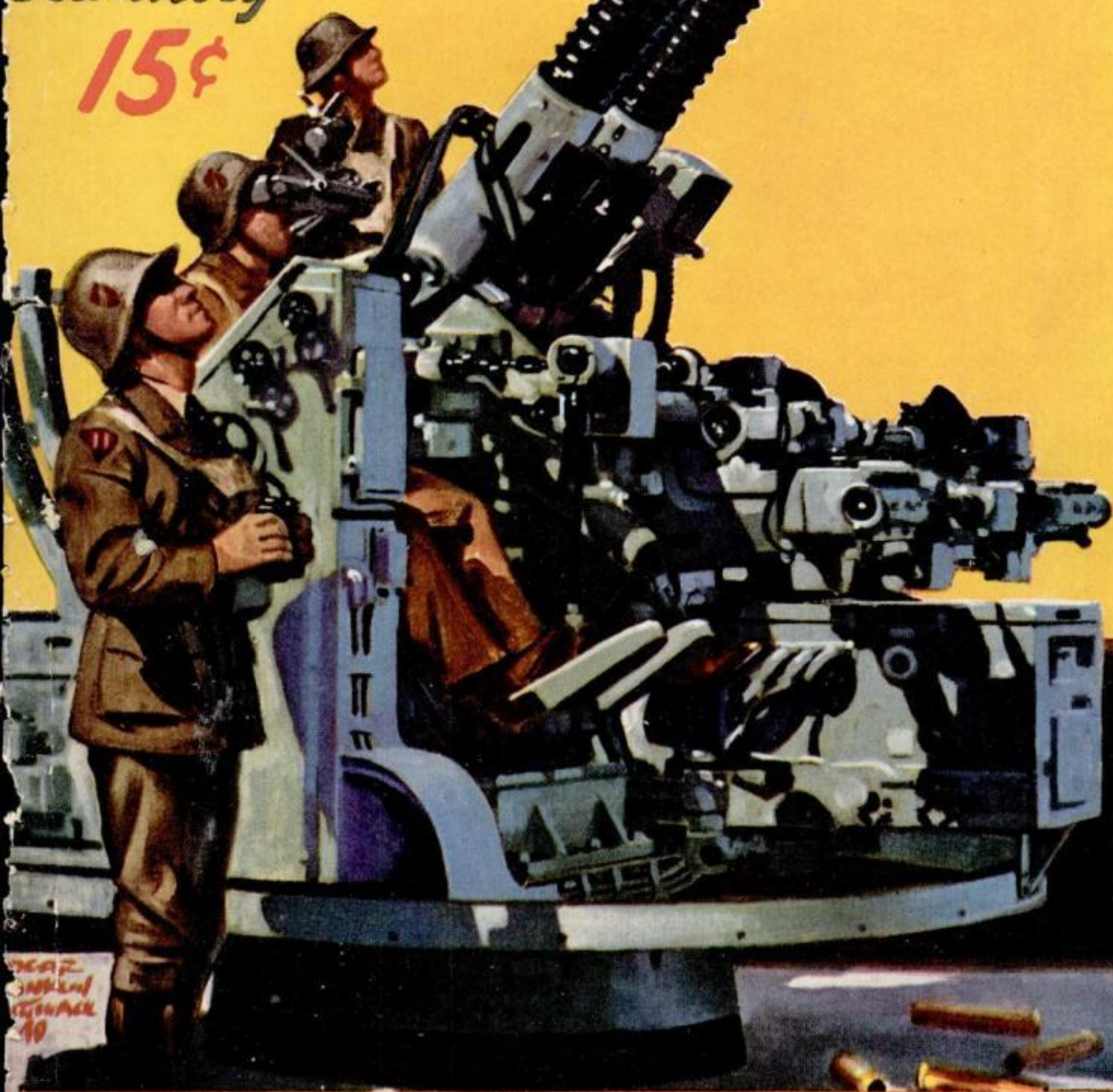


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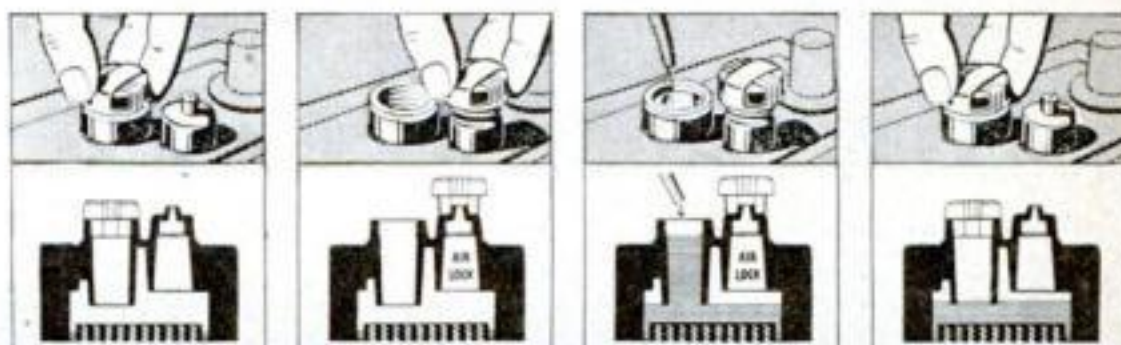
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CONTENTS FOR JANUARY 1940

G-Men Go After Spies.....	51
Making of an Army Flyer.....	57
Photographing a 90-Mile Tunnel.....	76
Mine Yields Mushroom Gold.....	82
How Many Fish in the Sea?.....	88
One-Man Factory Made from Junk....	92
Models Aid War on Erosion.....	98
Fighting the Air Raiders.....	102
Machine Picks Seeds That Grow.....	108
Q-Boats—an Answer to Submarines....	114
Amateur Collects 500,000 Fossils.....	118

Features and Departments

OUR READERS SAY —.....	12
IDEAS FOR HOME OWNERS.....	30
NEW HOUSEHOLD APPLIANCES.....	124
THE MAN WITH THE NET.....	127
POPULAR SCIENCE QUESTION BEE.....	130
UN-NATURAL HISTORY.....	131
GUS WILSON'S MODEL GARAGE.....	132
AMATEUR PHOTOGRAPHY.....	148
NATIONAL HOMEWORKSHOP GUILD.....	165
ADVENTURES WITH YOUR MICROSCOPE.....	198
HOME-LABORATORY CHEMISTRY.....	201
RADIO DEPARTMENT.....	204
USEFUL HINTS FOR MOTORISTS.....	210

AUTOMOBILES

Arrows on Streets Guide Tourists.....	54
Bag on Car Roof Holds Gas Fuel.....	54
New Pliers Replace Brake Springs.....	55
Car Heater Warms Baby's Food.....	113
Clamps Help Put On Tire Chains.....	126
Studs Get Truck Through Mud.....	210
Clothes Hook Makes Pipe Rack.....	210
Luggage-Trunk Picnic Table.....	210
Radiator Bears Owner's Initials.....	212
Old Pump Tests Windshield Wiper.....	212
Iron Pipe Stiffens Bumper.....	212
"Solder" Filler for Body Jobs.....	214
Winter "Breaks In" Tires.....	214

AVIATION

Television Four Miles Up.....	68
Sky Writers Play Ticktacktoe.....	71
Mechanic Fixes Flying Plane.....	75
Radio Car Aids Glider Pilots.....	97
"Thermal Sniffer" for Glider.....	101
500-Passenger Seaplane Designed.....	105
Rented Plane Carries Alarm Clock....	111

HEALTH AND HYGIENE

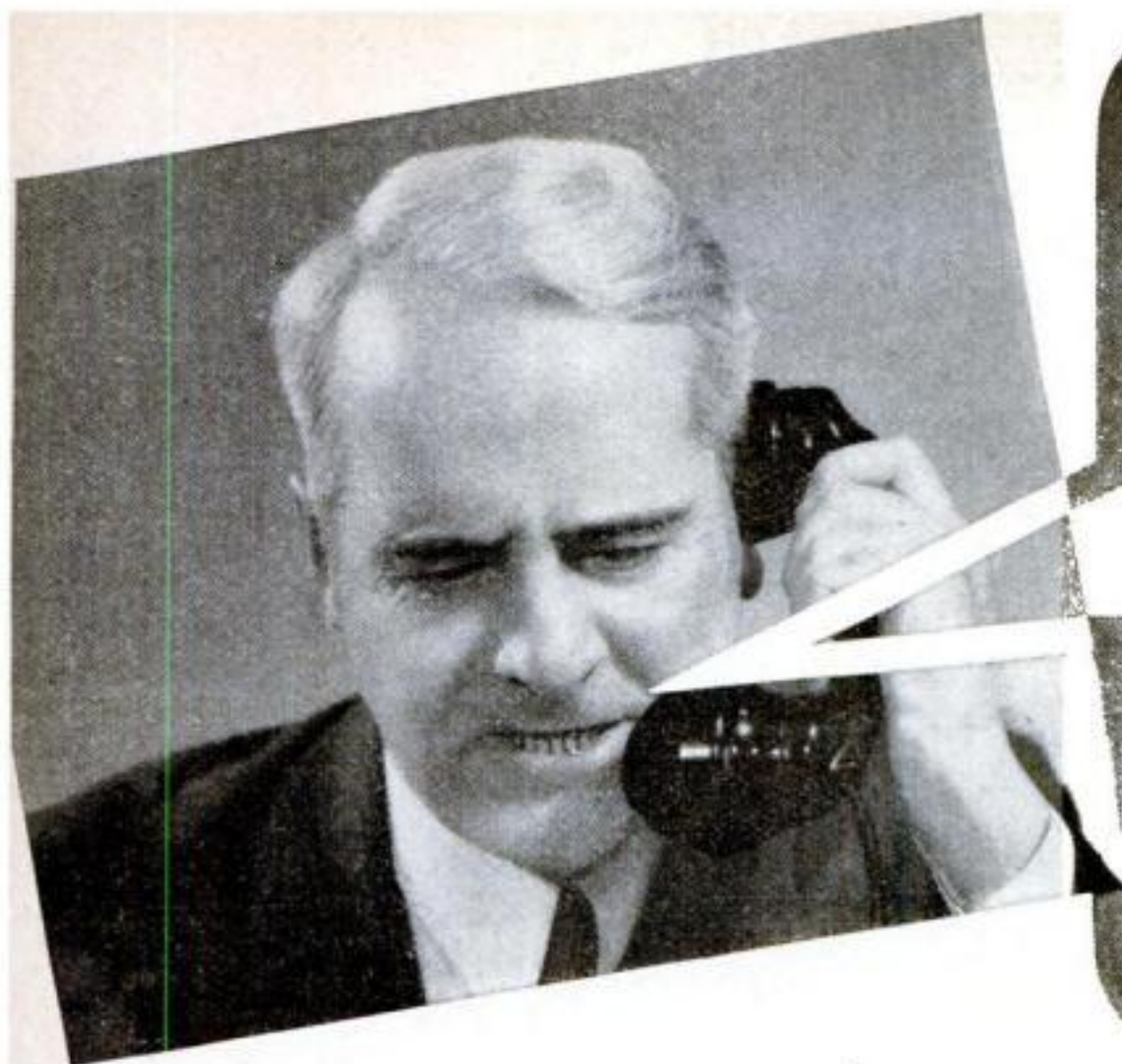
Eye Tester Dials Prescription.....	65
Vaporizer Rests Feet.....	70
Do Muscles Work When We Think?....	87
Robot "Rat" Tests for Vitamins.....	96
Pineapple Juice as New Remedy.....	106
Rehearse Gas-Raid Operation.....	112

HELPS FOR HOME OWNERS

Paint-Spray Gun for Home Use.....	30
Kit for Household Mending.....	30

THE HOME WORKSHOP begins on page 135

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CONTENTS [Continued]

Flameless Burner Removes Finishes.....	30
Hook Knots Clothesline.....	32
Kit for Linoleum.....	32

HOUSEHOLD AIDS

Container Keeps Cheese Fresh.....	124
Plate Holds Beverage Glass.....	124
Complete Kitchen in Cabinet.....	124
Salt Shaker Is Cakeproof.....	125
Combination Kitchen Tool.....	125
Brushes Clean Coffee Makers.....	125
Mittens Protect Housewife's Hands....	125

NEW INVENTIONS

Bottle Wiper Removes Moisture.....	55
Fireproof Cotton Mattress.....	56
Display Board Easily Shaped.....	56
Loop Hook Protects Sweaters.....	65
Life-Line Shock Absorber.....	66
"Leaded" Steel Cuts Costs.....	67
Electric Saw for Butchers.....	69
Basketball Table Game.....	70
Weight Tethers Baby Walker.....	72
Radio Timer Aids Announcers.....	73
Wallet Pocket Holds Keys.....	75
Hot-Air Fan Attachment.....	80
Water Pressure Sharpens Blades.....	81
Container Won't Spill Tooth Powder....	81
Plastic Used for Stocks of Guns.....	84
Chemical Process Skins Peanuts.....	84
Clock Needs No Winding.....	84
Flash Light Protects Hikers.....	85
Pail Has Built-In Heater.....	85
"Wool" Made from Corn.....	86
Novel Dressing-Table Mirror.....	87
One-Hand Fire Extinguisher.....	96
Telescoping Ash Stand.....	101
Drill-Press Milling Attachment.....	111
Invents Messproof Orange Peeler.....	112
Washed Air for Paint-Spray Booth.....	113
Strap Keeps Boots Flat on Skis.....	116
Accordionlike Tooth-Paste Tube.....	116
Folding Lamp for Typewriter.....	117
Barrel Pusher Is Time Saver.....	122
Pocket-Size Sander Renews Reeds.....	122
Loudspeakers for Police Cycles.....	126
Slashproof Hockey Shoes.....	127
Crimping Tool Applies Arrow Tips.....	127

PHOTOGRAPHY

Swivel Mount for Polarizer.....	128
Even-Margin Enlarging Easel.....	128
Speed Tester for Shutters.....	128
Watch Your Enlargements Develop....	129
Preset Exposure Meter.....	129

Lighting Outfit Is Portable.....	129
Photographing Your Handiwork.....	148
Washers Used for Tripod Head.....	151
Operating Single Stereopticons.....	151
Protective Varnish for Prints.....	151
Mirror Aids Candid Snapshots.....	152
Special Mask Saves Focusing Time.....	152
Flash-Bulb Exposure Guide.....	152
Mixer Agitates Roll-Film Tank.....	153
Several Rolls Developed at Once.....	153
Water for Photo Solutions.....	153
Photo-Printer Foot Switch.....	168
Eraser Polishes Ferrotypes Tins.....	224
Extra Hand Added to Clock.....	224
Pocket Safeguards Thermometer.....	224
A Rack for Drying Negatives.....	225
Fastening Lens Shade to Camera.....	225
Diluting Stock Developers.....	225
Wax Keeps Lens Carriage Firm.....	226
Flash Bulbs Remove with Sleeve.....	226

UNUSUAL FACTS AND IDEAS

Novel Ad Proves Its Point.....	54
Trout Caught in Street Drain.....	55
Fur Chart Aids Customers.....	56
Keeping It Dark Is His Job.....	65
Rattle Gives Air-Raid Alarm.....	67
Hoop Cycle Hits Fast Clip.....	67
Giant Soap Carving.....	69
Hitch-Hiker Gets a Big Hand.....	69
Modern Violin Maker.....	70
Dogs Trained for Polar Trip.....	72
"Land Battleship" Has Big Guns.....	73
Soils Tested for Foundations.....	74
Firemen's Cat Answers Alarms.....	75
Gardens Grow in Sandbags.....	80
Restaurant Newspaper Rack.....	80
Hotel Has Air-Raid Sentry.....	81
Women Vie at Paper Hanging.....	85
Movie Wind Machine Saves Oil Well..	86
Hearing Aid Works for Dogs, Too.....	86
What To Wear in an Air Raid.....	95
Bounty Crop on One Stem.....	96
Plastic Pergola and Fountain.....	100
Record Meteor Found by Reader.....	101
Dummy Flags Gas-Station Customers	105
Cut-Outs Help Choose Hair-Do.....	106
Raid Shelter Has Emergency Tools....	106
How To Gather Star Dust.....	107
Amazing Siamese-Twin Snakes.....	111
Braille Globe Aids the Blind.....	113
Lights Trace Cyclist's Movements.....	116
Four-Ounce Gas-Raid Costume.....	117
Novel Jig-Saw Stationery.....	117
Repair Shop Is Squirrels' Home.....	122
Fish Ride Elevators and Trucks.....	123

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CONTENTS [Continued]

CRAFTWORK

Wire Decorates Candlesticks.....	145
Cocktail Tray Has Cork Face.....	158
Beautiful Alabaster Craftwork.....	170
Hammered-Brass Door Knocker.....	171
Plywood Cover for Photo Album.....	174
Stamps Ornament Lamp Shade.....	179
Cutters Aid in Soap Carving.....	183
Toy Truck Holds Small Child.....	195

HINTS FOR THE HANDY MAN

Installing Fluorescent Lamps.....	136
Butter Tray Rests on Toaster.....	139
How to Fold Circulars Quickly.....	139
Cotton Kept in Cup Dispenser.....	139
Art Clippings Hang over Board.....	140
Phonograph Needle Cuts Celluloid.....	140
Trips Shown on Jig-Sawed Map.....	140
Motor Drives Pencil Sharpener.....	140
Knife Made from Hack-Saw Blade.....	141
Cork Holds Thumb-Tack Supply.....	141
Pocket Clip for Refill Pencil.....	141
Cellulose Film Colors Mirrors.....	141
Pulleys Removed with C-Clamps.....	141
Metal Edges Applied to Skis.....	142
Trough Made from Water Tank.....	144
Shifting Letters on Marquee.....	145
Eraser Acts as Bottle Stopper.....	145
Wrench Adapted for Cutting Pipe.....	145
A Strong Waterproof Cement.....	145
Ideas for the Shipshape Home.....	146
Christmas Lighting Effects.....	154
Cottage Wins Spool Contest.....	156
Bushing Aids Bottle Drilling.....	158
Lathe Lighted by Desk Lamp.....	158
Grinder Built from Vibrator.....	159
Mechanical Fingers Pick Litter.....	159
Improvised Price-Ticket Holder.....	159
Pliers Grip Small Round Work.....	163
Striping Auto with Ruling Pen.....	163
Lathe Collet Holds Drill Chuck.....	163
Making Erasures on a Hectograph.....	163
Fitting Provides Air-Hose Nozzle.....	164
Fastening Bristles in a Brush.....	164
Outlets Installed in Baseboard.....	164
Pencil Used as Penholder.....	164
Spring Catch Holds Door Open.....	168
Handle Tightens Hand Screws.....	168
Oilstone Trued on Rubbing Brick.....	168
Replacing Broken Tenon on Chair.....	169
Wings for Your Ice Skates.....	172
Old Silk Stockings Strain Paint.....	174
Filter Connected to Compressor.....	175
Holder for Table-Tennis Balls.....	175
Small Stumps Removed with Puller....	175
Holder Replaces Ceiling Bulbs.....	175
Clerk's Pencils Bound Together.....	182
Cans for Holding Small Parts.....	183
Steel and Babbitt Fix Furniture.....	183
Latch on Ladder Aids Planing.....	183

(Continued on page 8)

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CONTENTS [Continued]

Case Holds Set of Twist Drills.....	184
Jointer Scale Shows Cut Depth.....	184
Wiper Helps in Wet Sanding.....	184
What You Can Do with Rubber Tape..	185
Brightening Up a Breakfast Set.....	196

MODELS

Model Maker's Carving Tools.....	162
Rigging Our Topsail Schooner.....	180
Miniature Ladders for Ships.....	182
Cutting Sharp Balsa Carvings.....	182

NEW SHOP IDEAS

Repairing an Electric Motor.....	187
Cone Center Made from Fan Parts.....	190
Head Lamp Converted into Anvil.....	190
Tap Used as Driver for Screws.....	190
Shop Burner for Tempering Tools.....	191
Jig for Holding Metal Pins.....	191
Cleaning Electric Clock in Shop.....	191
Strainer Skims Slag from Solder.....	191
Lathe Boring and Milling Table.....	192
Steel Clamps Hold Small Parts.....	192
Scale Speeds Up Wood Turning.....	192
Tool Bores Work in Carriage.....	192
Mercury Indicator for Centering.....	193
Two Ways to Make Odd-Sized Nuts....	193
Pedal Pads Used on Vise Jaws.....	193

SHOP DATA FILE

Ways to Connect Dry Batteries.....	138
Setting and Filing Band Saws.....	139
Flash-Bulb Exposure Guide.....	152
Water for Potographic Purposes.....	153
Model Maker's Carving Tools.....	162
Dimensions of Iron Pipe.....	190
Standard Filler Stains.....	196
Enameling over Mahogany Stain.....	197

WOODWORKING

Clamping Knob for Ripping Fence.....	140
Choosing Tools for Your Workshop.....	160
Tool Finds Wood-Turning Centers.....	163
Cabinet Built under Water Heater.....	169
Combination End Table and Lamp.....	176
Scroll-Sawed Boudoir Mirror.....	178
Simple Shuttle for Hand Loom.....	178
Footstool in Duncan-Phyfe Style.....	179
Wood Shaping on the Drill Press.....	186
Setting Up the Frame of a Boat.....	194

RADIO

Combination Radio and Bed Lamp.....	204
Convenient Battery Eliminator.....	204
Transformer-Terminal Shield.....	204
Clamp Stand Holds Soldering Iron.....	204
Map of World Is Indoor Antenna.....	205
New "B" Supply of Small Size.....	205
Tiny Arc Heats Soldering Tool.....	205
Table Radio Resembles a Book.....	206
Tom Thumb Midget Receiver.....	209

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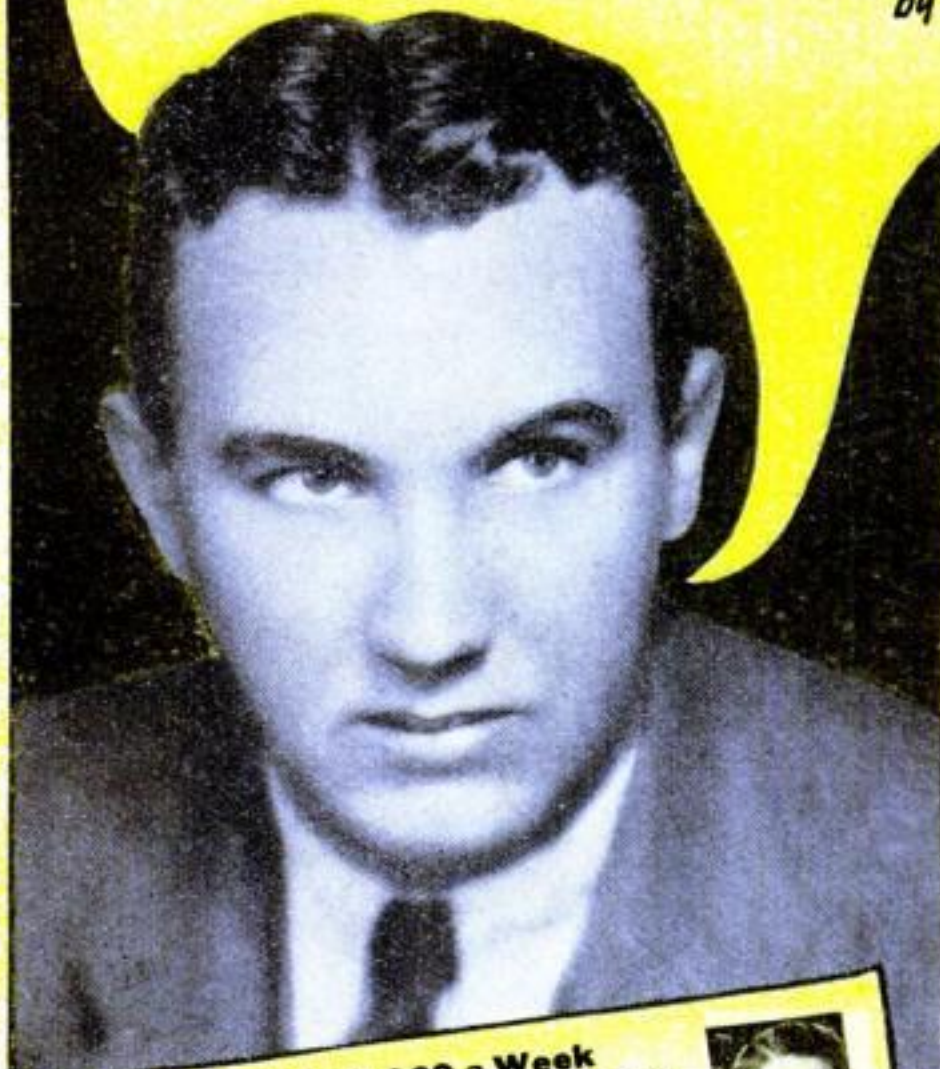
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predict much about our own. Who suffers? To name a few, the commercial air lines, the merchant marine, farmers, marketers of countless articles of merchandise, amusement providers, railroads, and so on. It all boils down to this: Whatever importations a foreign war makes us give up, one of the most vital to our needs is weather reports—and yet, the weather keeps on coming in. Why not an international weather bureau? —T. N., Los Angeles, Calif.

(Continued on page 14)

predict much about our own. Who suffers? To name a few, the commercial air lines, the merchant marine, farmers, marketers of countless articles of merchandise, amusement providers, railroads, and so on. It all boils down to this: Whatever importations a foreign war makes us give up, one of the most vital to our needs is weather reports—and yet, the weather keeps on coming in. Why not an international weather bureau? —T. N., Los Angeles, Calif.

Will He Save Fuel by Letting His House Cool Off at Night?

THERE appear to be two types of thermostatic controls for furnaces, and I can't find out which is better to install in my home. One type has a wall thermostat for, say, your living room, with a motor in the cellar to open and close the furnace dampers automatically to maintain any desired temperature in the living room at which the thermostat is set. The other type is fundamentally the same, except for the addition of a clock to the thermostat, the purpose of which is to move the temperature-setting regulator of the thermostat to a lower point during the night. Before I can

THAT'S THE ORIGINAL
RIDDLE OF THE SPHINX!



make up my mind which type to buy, I want to know if it really is a good idea to let your house cool off during the night. It seems to me that, while it might save fuel the amount saved would be used up anyhow to bring the temperature of the house up to normal again. Among engineering acquaintances of mine, some say one thing, some another. Can anyone help me out?—O. T. F., Dayton, Ohio.

Some Day the Filling Station Will Not Be There

OF ALL the improved gadgets on the 1940-model cars, there's one in particular that several makes carry that deserves a medal. That is the device on the dashboard gasoline gauge that warns the driver when his gas is getting low by flashing a little red signal. For, unfortunately, all drivers can't be as lucky as a friend of mine, who is *always* running out of gas—not because he's dumb, but because he just doesn't give a darn.

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Our Readers Say (CONTINUED)

He'll be nearly up to the top of a hill when his engine starts sputtering; by a superhuman effort he nurses it over the crest and coasts down into the valley beyond, where there is *always* a filling station. Sometimes, just to throw a scare into his nervous wife, he passes up the first station, saying he doesn't like the looks of the joint, and rolls to a stop just a hose length from the pump of the next one. He's a card!—P. E. W., Schenectady, N. Y.

"Boon to Bandsmen" Has Him Stumped

CHOKING OFF THE
NOISE IS THE
IDEA!



IN THE November issue under the heading "With the Inventors," you mention an invention described as a "boon to bandsmen." It's a fur coat for musical instruments, to keep the player's hands warm in cold weather. The thing certainly has me stumped because it's my understanding that ninety-five percent of the "squeals" come out of the holes in the side and not out of the bell. Please explain what happens to the noise inside the "boon."—L. R. N., Denver, Colo.

Poor Old Chris' Columbus Certainly Could Take It!

POOR old Columbus! He certainly has proved that he could take it. History books go to great pains to show what he went through to make his explorations, and he must have been a great man ever to have got started at all. But some of the things hung on him are neither flattering nor deserved. The fallacy that he was the discoverer of America persists in our school books even though Lief Ericsson, Norse navigator, beat him to it by nearly 500 years, and the theory that he discovered that the world was round can't seem to be downed, even though a Greek mathematician wrote about it 2,000 years earlier. Now we learn that scientists poring through documents in Mexican and Central American archives have turned up facts to show that poor Columbus may get the blame for something else he didn't do, namely, the bringing of hard liquor to America. Before the arrival of Columbus on these shores, they point out, alcohol was not a social or

UH-HUH, BUT COLUMBUS
HAD SENSE ENOUGH
TO ADVERTISE HIS
DISCOVERY!



(Continued on page 16)

physiological problem. Neither, it should be pointed out, were reckless driving, gangster movies, news analysts, nor pedants. Let's not hang so much on the worthy old explorer!—C. A. L., Washington, D. C.

And Harness Lightning To Electrolyze the Water?

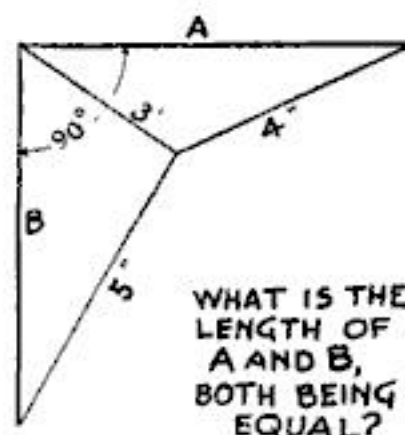
G'WAN, IT WON'T WORK!



IT'S FUNNY inventors don't try making a car that will use water instead of gasoline. In my opinion, it should work something like this: Fill up the tank with water. Then, by the process of electrolysis, break up the water into its two components, oxygen and hydrogen. The oxygen, which will support combustion, and the hydrogen, which burns, can be passed into the combustion chambers and exploded by the usual spark plugs. Sounds silly, I'll admit, but I'll wager that it can and will be done. Thereafter, instead of turning in at a gas station and saying "Five gallons please," you can simply run to a water hose and yell "FILL 'ER UP!"—A. R. P., Pittston, Pa.

Maybe This Reader's Problem Will Get Under J. T. C.'s Skin

FOR a good many years now, I've been a steady subscriber to your magazine, and have always looked forward to the next issue. Of course, there are a few articles that I am not interested in, now and then, but I know that there are a lot of other people who like them, so this is no criticism. I especially like "Our Readers Say," but once in a while some one gets under my skin. For example, J. T. C., of Orange, N. J., who so basely criticised the girl drum majors and your article about them must have a queer conception of music or he would know that the basis of music is rhythm. And who is more capable of portraying it than a healthy, beautiful girl full of life and energy. I think the trouble with him is that he must be getting old and is blind to the beauty of health, talent, and rhythm all in one in the form of the beautiful girl drum majors. That's that! Now, may I offer the attached geometry problem that I would like to pass on to your readers?—G. H., Sioux City, Iowa.



WHAT IS THE
LENGTH OF
A AND B,
BOTH BEING
EQUAL?

YOU CAN!

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| <input type="checkbox"/> House Planning | <input type="checkbox"/> Machinist | <input type="checkbox"/> Structural Drafting |
| <input type="checkbox"/> Management of Inventions | <input type="checkbox"/> Managing Men at Work | <input type="checkbox"/> Structural Engineering |
| | | <input type="checkbox"/> Surveying and Mapping |
| | | <input type="checkbox"/> Telegraph Engineering |
| | | <input type="checkbox"/> Telephone Work |
| | | <input type="checkbox"/> Welding, Electric and Gas |
| | | <input type="checkbox"/> Woolen Manufacturing |

BUSINESS SUBJECTS

- | | | |
|--|--|---|
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| <input type="checkbox"/> Business Correspondence | <input type="checkbox"/> Business Management | <input type="checkbox"/> Illustrating |
| <input type="checkbox"/> Cartooning | <input type="checkbox"/> C. P. Accounting | <input type="checkbox"/> Lettering Show Cards |
| <input type="checkbox"/> Civil Service | <input type="checkbox"/> Cost Accounting | <input type="checkbox"/> Railway Postal Clerk |
| <input type="checkbox"/> College Preparatory | <input type="checkbox"/> Foremanship | <input type="checkbox"/> Salesmanship |
| <input type="checkbox"/> College Subjects | <input type="checkbox"/> French | <input type="checkbox"/> Service Station Salesmanship |
| <input type="checkbox"/> Grade School Subjects | | <input type="checkbox"/> Signs |
| | | <input type="checkbox"/> Spanish |
| | | <input type="checkbox"/> Stenography and Typing |

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- | | |
|---|--|
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| <input type="checkbox"/> Foods and Cookery | <input type="checkbox"/> Tea Room and Cafeteria Management, Catering |
| <input type="checkbox"/> Home Dressmaking | |

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Our Readers Say (CONTINUED)

So He Tried It Himself Result: Swell Pictures!

WAS particularly interested in the article about the chap who took aerial pictures with his camera fastened to a kite. So I tried the stunt myself. I had a box kite and a miniature camera, but I couldn't find a fuse or wick good enough to stand the wind. After

BEN FRANKLIN
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ANYTHING ON
ME!



fussing around, I discovered that a stick of slow-burning oriental incense like the kind used to set off fireworks would work. I have one swell picture from my very first try. Of kites in general, I have made an aerial running around the edge of one, connected to a wire on which the kite is sent aloft. It gives me fine recep-

tion with a good crystal circuit.—I. E. D., Shreveport, La.

It's Just One of Those Things Your Best Friends Won't Tell

SAY, what went wrong with your linotype operator and proofreader last month? I took that personality test, answering all the questions in good faith. Then, when I turned to page so-and-so to check my answers, imagine my surprise to find that I had said the wrong thing nearly every time! Either your test is all wet, or I'll have to find me a nice, comfortable desert island to live on. Can't you restore my self-confidence by telling me that the linotype operator's fingers were all thumbs the day he set those answers, or that the compositor got a little balled up when he arranged the columns of answers?—M. F., Owosso, Mich.

Who Knows What Made Old Sol Cut Capers?

LAST Fourth of July, I was at my cottage at East Point, Put In Bay, Lake Erie, Ohio. The cottage faces northwest. About twenty minutes before sunset, I was gazing out over the waters of Lake Erie when to my astonishment I noticed that the great disk of the sun was pure white, like silver. Never before had I seen a silver sun. Suddenly the disk began to revolve rapidly to the left for perhaps ten seconds, then stopped, but instantly turned in the opposite direction. The revolutions reminded me of a big circular saw going through a log, or a spinning wheel in a fireworks exhibition. I called my wife. Without prompting, she exclaimed, "Why, it's turning." Altogether, six of us saw it, our ages varying from twelve to seventy-nine. Obviously, scientific light on this mystery is

desirable, and I cannot think of any better place to look for it than in the pages of POPULAR SCIENCE MONTHLY.—W. P. H., Mt. Sterling, Ky.

Limited to Just One Magazine It Would Be P. S. M.

You certainly are doing a fine job in your great publication. If I were stranded in a place where I had to select one magazine for reading, I would whole-heartedly select POPULAR SCIENCE. Your magazine is great because it is so well balanced in its contents. Keep up the good work.—J. D. P., Kansas City, Mo.

"HOW TO LIVE ALONE
AND LIKE IT"
THAT'S ME!



Well, It Wouldn't Be Summer Without a Few Mosquitoes

IN REPLY to the query of K. S. P., of Glen Ridge, N. J., I am sorry to state that the best he can hope for is just one more summer without insects. Such a condition as a drought seldom disturbs the balance of nature permanently. Unless the mosquito has been almost exterminated, the balance will be the same again two summers hence at the most.—W. T., Valley Falls, R. I.

Take His Word for It, or Just Take an Aspirin

K. A. M. wants the matter of the speed of the treads on the Army tank he saw cleared up. The explanation for the paradox he describes is really quite simple. The upper part of the tread would, if the fighting machine were jacked up, move forward at the rate of twenty miles an hour, in the example given. The lower section would move backward at the same speed. But actually it is touching the ground, and so moves the tank instead of moving itself. The tank is going along at twenty miles an hour. The section of the endless tread which is at the top at the moment is doing twenty in its own right. Add this to the tank's twenty and you get forty. If K. A. M. won't take my word for it, he can join the Army and see for himself. Or, he can take an aspirin, if he can't spare the three years.—F. A. B., Chicago, Ill.

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SEEN A TANK YET!



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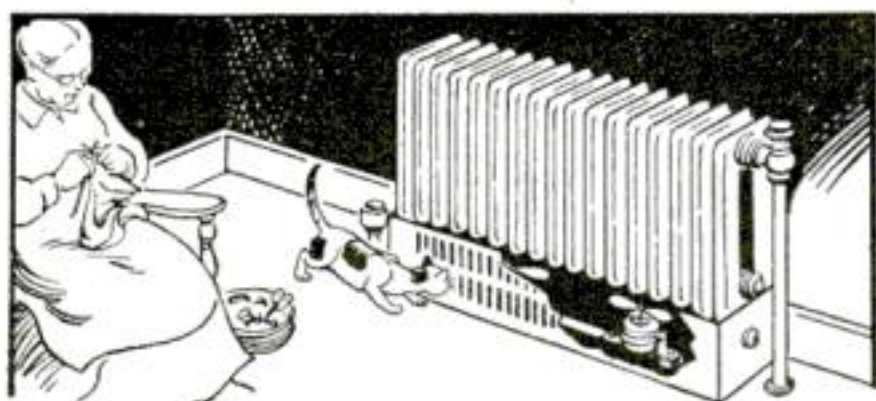
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With the Inventors

TO INCREASE the circulation of warm air throughout a room, Clarence M. Woolley, of New York City, conceived the idea of installing a brace of electric fans beneath a radiator. To provide room for the fans, which are mounted on a metal base and pointed upward, the radiator legs are jacked up on supports attached to the floor.



The base of the radiator is then incased in a metal covering fitted with slot openings through which air is drawn in, to be heated as it is blown up through the radiator sections and thence out into the room. A switch on the metal covering turns the fans on or off . . . IN PATENT OFFICE PARLANCE, an "interference" is declared when two or more parties claim the same patentable invention. Proofs are advanced by both claimants to show which one conceived and developed the idea first . . . WORKMEN OPERATING chipping hammers or similar power tools are effectively protected from flying particles by an adjustable safety guard that is said to be superior to present types in that it is not



easily jarred loose by vibration and does not interfere with the operation of the tool. Instead of being attached to the tool itself, the wire-screen guard is fastened to a bracelet strapped around one of the operator's wrists, and adjusted to deflect flying chips downward and away from the work. This is the invention of Thomas

Digman, of Pittsburgh, Pa. . . . A PROMINENT WRITER ON PATENTS states that, in the long run, an inventor is better protected if he explains his idea in detail early in the game to

(Continued on page 22)

trustworthy friends, rather than if he keeps it a deep secret from everybody . . . COMPACTLY HOUSED IN A CONTAINER resembling a mailing tube, a novel umbrella invented by

Guillermo Solomon, of Santiago, Dominican Republic, is made of rubber. When it rains, the owner inflates the umbrella by pumping it up. To accomplish this, the container serves as a pump cylinder, while the umbrella shaft acts as a piston . . . OF MORE THAN 3,000,000 printed copies of inventions and nearly 1,000,000 photostatic copies



sold annually by the U. S. Patent Office, about half are purchased by foreign countries and public libraries . . . IN ORDER TO CONSERVE cargo space in the body of a long-distance freight motor truck, Earl A. Kounkel, of Sioux City, Iowa, proposes removing the relief driver's sleeping space from the conventional position in back of the driver's seat to a fore-and-aft space partially over the engine. The driver rests his head on the right-hand side of the cab seat, the middle part of his body on a removable mattress placed between the seat and the dashboard, and his legs and feet on a mattress installed within an insulated chamber projecting forward toward the radiator over the truck's



motor block . . . QUESTION: WHICH FIELD of invention is apt to pay the inventor bigger returns, railway locomotives or children's toys? Answer: Children's toys . . . BATH-TUB, TOILET, LAVATORY, and clothes hamper are all combined in a single bathroom unit designed by S. J. S. Stanton, of Chicago, Ill. The tops of the lavatory and the hamper are

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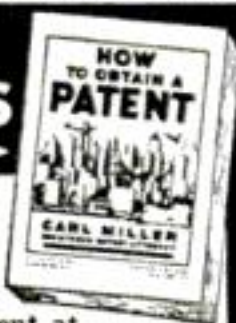
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With the Inventors

(Continued from page 20)

on the same level, separated by a lower toilet bowl whose cover serves as a step for mounting to the higher level of the bathtub which



backs up the three other units. The arrangement should simplify the problem of outfitting a complete bathroom in a restricted space . . . UNITED STATES PATENT No. 1 was

granted to a Senator, John Ruggles, for an invention relating to locomotive wheels . . . LIP-STICK AND CIGARETTE HOLDER are combined in a novel item for women, developed by Samuel M. Peck, of New York City. When used for smoking, the unit has a cigarette holder at one end connected to a mouthpiece at the other by a smoke channel that by-passes a built-in lipstick. To use the latter, the owner removes the cigarette mouthpiece . . . WITHIN THE LAST FIVE YEARS, the number of design patents issued



annually has doubled. More than 4,000 are now issued every year . . . A NOVEL METAL GUARD devised by C. S. Prince, of Washington, D. C., prevents ice in a glass from spilling out when the glass is tipped up in drinking position. Held near the top of the glass

(Continued on page 24)

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With the Inventors

(Continued from page 22)

by friction against the edges, the guard is perforated to allow liquids to flow through while keeping back the ice . . . IT WOULD COST YOU ABOUT \$10,000 to secure a patent on one invention in all the civilized countries of the world . . . ANOTHER NOVEL COMBINATION of separate items forms the basis of a design patent issued to Paul S. Madsen, of Bethany, Conn. This is a pocket comb, with the edge opposite the teeth marked off as a six-inch ruler, and one end fitted with a scale permitting the device to be used also as a protractor . . . THE ONLY U. S. PRESIDENT to whom a patent has ever been issued was Abraham Lincoln.



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plate invented by Alois Knotz, of Graz, Austria, is used. Designed to form part of the cash register, the plate has a registering mechanism that indicates the exact amount of the sale. The customer places his money on the glass cover of the unit and receives his change on it . . . ONE OF THE STORIES told about Thomas A. Edison is that

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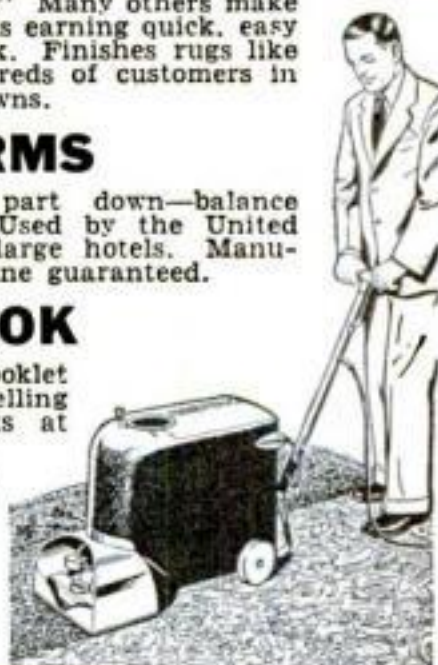
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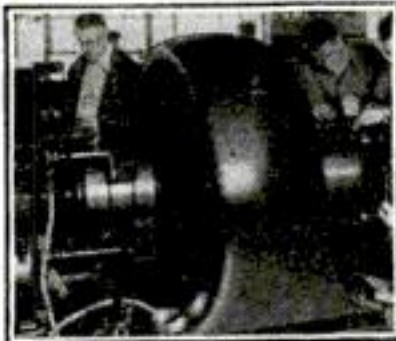
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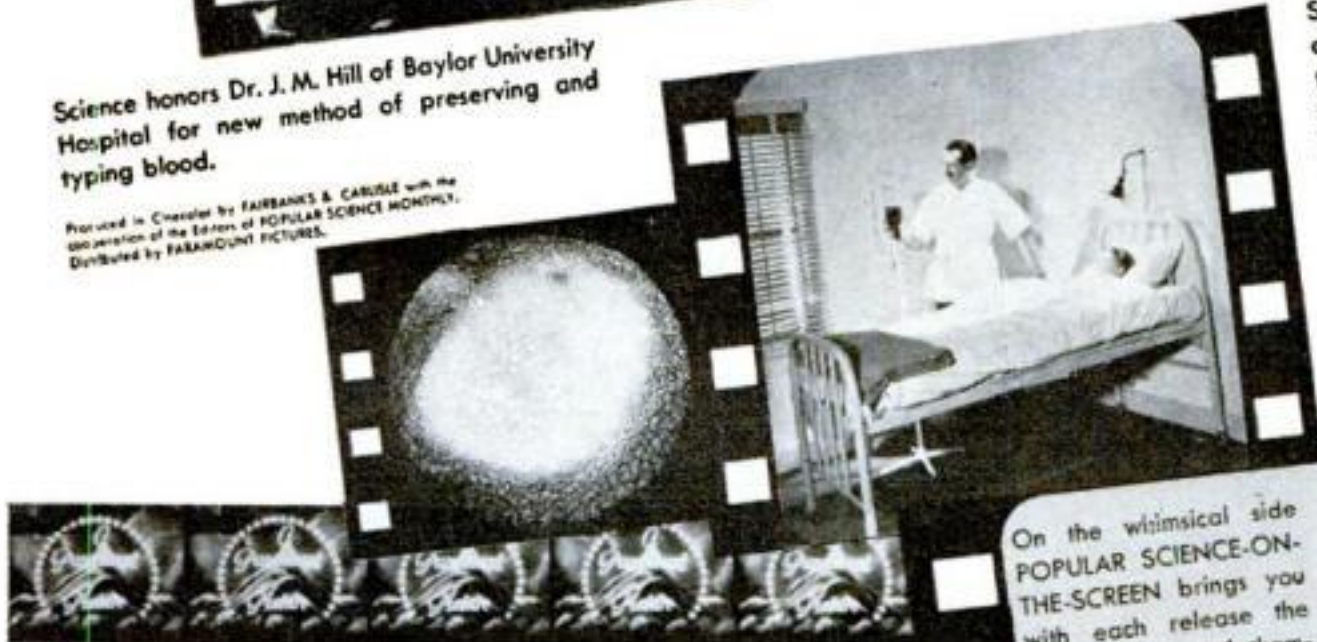
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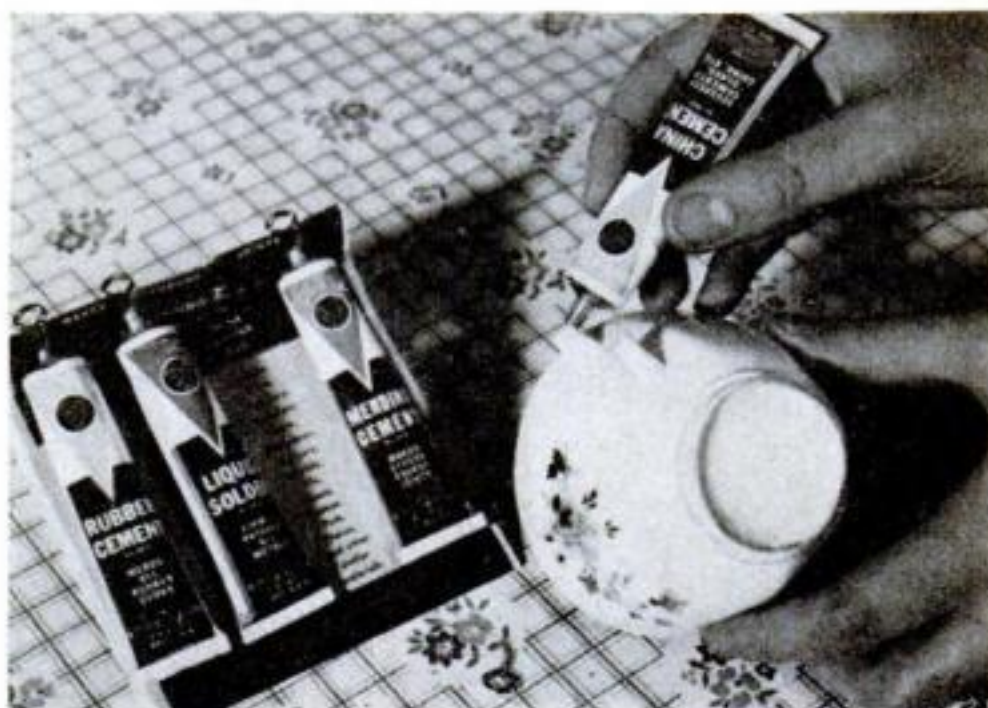


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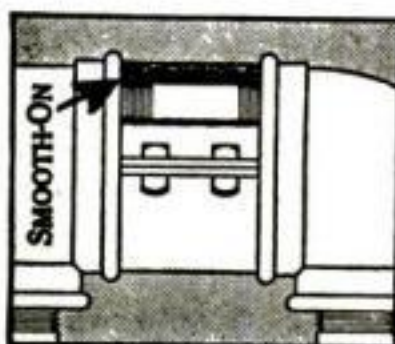


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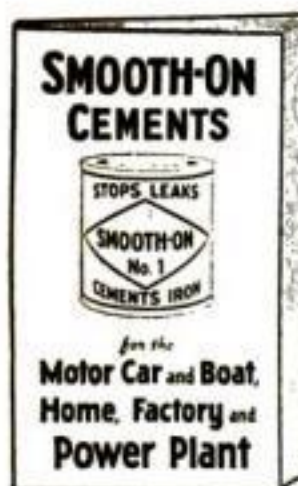
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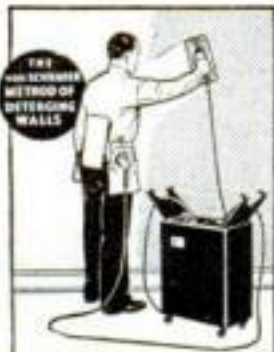
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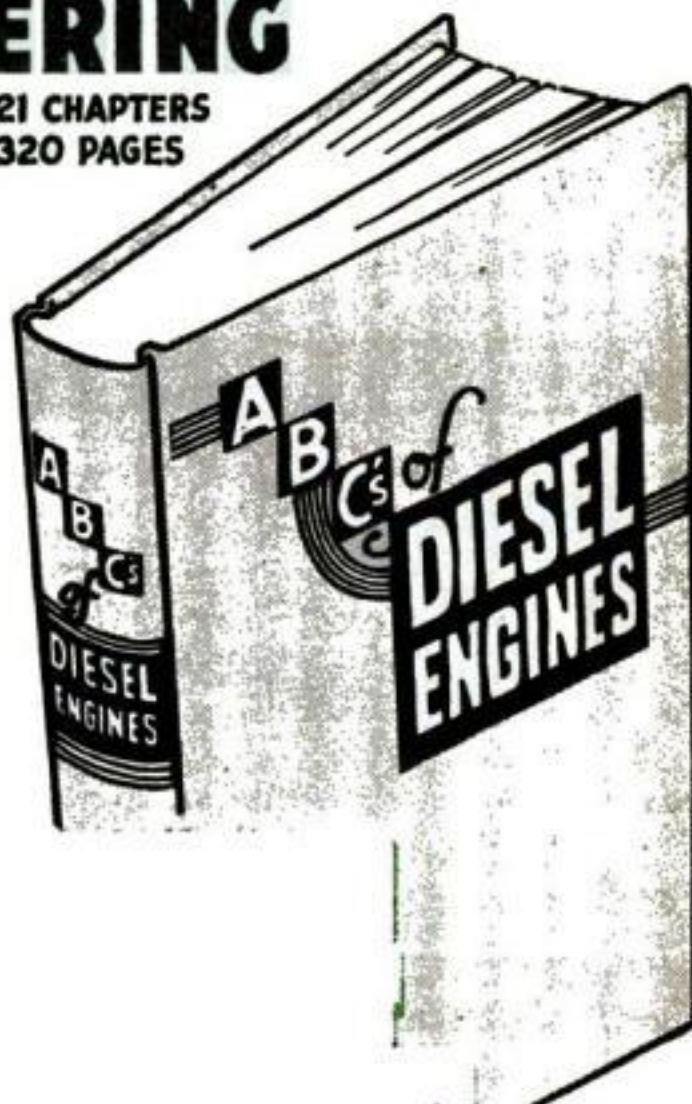
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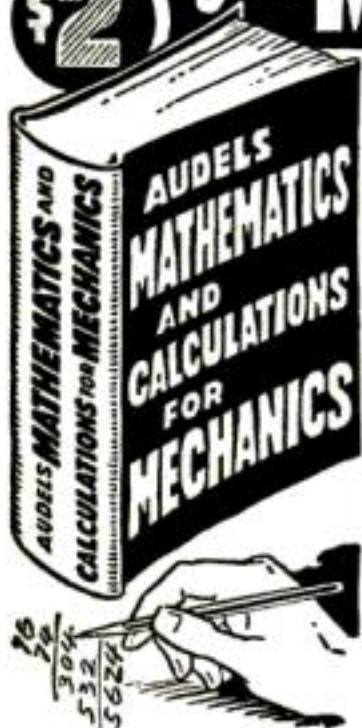
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ROLL developed 8 prints and two enlargements 25c. Beautiful photographic Christmas Cards or Calendars from your negatives, 4 for 25c; 17, \$1.00, envelopes included. Young Photo Service, 406-C, Albany, N. Y.

8 ENLARGEMENTS—films developed plus 8 enlargements, 25c coin—116 or smaller. Enlarge Photo, Box 791, Dept. PSM, Boston, Mass.

FOR the discriminating amateur. Rolls developed and 2 prints each 25c. Reprints 3c. Superior workmanship. Same day service. Paramount Co., 327 E. 92nd St., New York.

AT Last! All your snapshots in natural colors. Roll developed, 8 natural color prints, only 25c. Reprints, 3c. Amazingly beautiful. Natural Color Photo, Janesville, Wisconsin.

CANDID special: 35 Millimeter rolls enlarged to 3 1/2 x 4 1/2, \$1.00. 18 Millimeter rolls, 60c. 3 1/4 x 4 1/2 reprints, 3c each. Brown Photo Company, 1910-60 Emerson, Minneapolis, Minn.

35MM. Films fine-grain developed 36 enlarged prints 3 1/4 x 4 1/2 \$1.00. Mailing bags and literature free on request. Photo-Electro Lab., Box 861, Dept. B, Bridgeport, Conn.

ROLLS developed. Two sets prints plus enlargement coupon, 25c. Reprints, 3c. Over 19 reprints, 2 1/2c. Jones Studios, Davenport, Iowa. "Where the West Begins."

FILM developed and printed returned same day with two enlargement coupons, 25c. Whitmore's Photo Service, Litchfield, Minn.

ROLLS developed, two prints each and two free enlargement coupons, 25c; reprints, 2c each; 100 or more, 1c. Summers' Studio, Unionville, Mo.

20 REPRINTS 25c, 100—\$1.00. Roll developed 16 prints 25c. 5 x 7 enlargements 10c. 3—25c. Nordskog, 58, Maywood, Ill.

FILM Developing bargains! Hurry! Save! Write for free mailers and details now. Modern Studios, Dept. PSM, LaCrosse, Wis.

PROFESSIONAL, overnight service. Developed, printed, 2 enlargements, 25c. Fotoservice, 1942 Marlow, Toledo, Ohio.

ENLARGEMENT from each picture on your roll 25c. Cut Rate Photos, Dept. A-6, Janesville, Wisconsin.

BEAUTIFUL Photographic Christmas cards, 75c dozen. Send negative and 10c for sample. Hensch Studios, Harrisburg, Pa.

GUARANTEED. Roll developed, 16 prints 25c. 20 prints 25c. Quality Photo, Hutchinson, Kansas.

EIGHT Silvertone gloss enlargements or eight prints and two enlargements, 25c. Mayfair, Box 261-A, Toledo, Ohio.

COMPLETE developing—printing outfits \$2.95. Cromwell, 204 Griffin, Atlanta, Ga.

ROLL developed, 16 guaranteed prints 25c. Smart Photo, Winona, Minn.

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FLASH press cards like reporters—25c. Journalists, 1727 Lee, Evanston, Ill.

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MAKE Money with poultry. Read America's leading poultry magazine for latest information. Three years \$1.00; nine months 25c. Poultry Tribune, Dept. C-91, Mount Morris, Ill.

LEADING Turkey magazine, devoted exclusively to turkey raising. Explains newest methods. \$1.00 a year. Turkey World, Desk 58, Mount Morris, Ill.

LOW Factory prices on Poultry Equipment. Wire fabrics. Free 100-page catalog. Bussey Pen Products, 5151 West 65th St., Chicago.

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HAMMERMILL letterheads, any color paper, ink; 300 8 1/2 x 11, \$1.48 postpaid—envelopes matching, \$1.15. 30 type styles. Samples. Woodruffs', 217-D Lewis, Duluth, Minn.

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QUALITY Business cards. Get our Cut-Rate offer. Shinn's Shop, Bellflower, Calif.

CORRECTLY designed printing cheaper—quicker. Samples. Sicocan, 2038 O'bear, St. Louis.

1000 LETTERHEADS \$2.50. Statements, Envelopes \$1.95. Standard Press, 106 N. 17, St. Louis, Mo.

SUPERIOR Printing, for less, trade illustrations free. Economic Printing, Leona, N. J.

BUSINESS Cards \$1.50 per 1000. Columbia Print, East St., Pittsburgh, Pa.

500 LETTERHEADS 5 1/2 x 8 1/2 \$1.00 250 envelopes .75 250 multigraphed letters \$2.00 Irving Letter Service 4123 N. Kildare, Chicago.

PHOTO Engraving—Modern method, without expensive equipment. Imagio, Bristol, Tenn.

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1000—ENVELOPES, letterheads, billheads etc.—\$1.75. Printers, 515 Sixth Ave., Brooklyn, N. Y.

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PRINT your own cards, stationery, circulars, advertising. Save money. Easy rules furnished. Print for others, big profits. Junior outfits \$8.25, senior outfits \$16.55 up. Details free. Kelsey Presses, H-8, Meriden, Conn.

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BARGAINS. Presses, type, List 3c. Exchange. A-27, 54 Liberty, Meriden, Conn.

SACRIFICE Automatic Card Press: will trade. Reid, Box 172, Webster, Mass.

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RADIO engineering, broadcasting, aviation and police radio, servicing, marine and Morse telegraphy taught thoroughly. All expenses low. Catalog free. Dodge's Institute, Poplar St., Valparaiso, Ind.

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QUICK Cash for your old coins. We pay big prices for wanted coins: certain 1909 cent, \$10; liberty head nickels before 1914 \$500; 1864, 1865 Indian head cents \$100 each; dimes before 1895 \$600; some worth \$6,000 each. Have you valuable coins in your possession? It will pay you to be posted—Send 15c for our illustrated coin catalog. National Coin Corporation, Uninc. (3), Daytona Beach, Florida.

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COIN Collectors' Illustrated Catalog of coins, books and accessories 10c. James Randell, 407 South Dearborn, Chicago.

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SONGWRITERS: Send your poem today for immediate consideration. Richard Brothers, 145 Woods Bldg., Chicago.

SONGWRITERS! Outstanding, amazing offer. Hibbeler, C-15, 2157 N. Avers, Chicago.

SONGWRITERS. Send original poems. America's finest service. Variety, Dept. G, Salem, Ind.

SONGWRITERS Wanted. Work guaranteed. Publication. Great Eastern, 40PS1, Thomaston, Maine.

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HUNTING, fishing, trapping, outdoor equipment, used guns. List and catalog free. Howe Fur Company, Coopers Mills, Maine.

ARCHERY Equipment and materials. Potter and Macquarrie, 3400 Fruitvale Ave., Oakland, Calif. Write for catalogue.

FIFTY Cent tournament arrows for twenty-five cents. 245 W. 71 St., Los Angeles.

SINKER Molds: Make your own sinkers. Free folder. Reading Instrument Co., Box 78, Reading, Pa.

BOW and arrow supplies. Catalog 15c. Roy Hancock, 323 Douglas Ave., Portsmouth, Va.

STAMP COLLECTING

"HORRORS Of War" Packet! Thrilling stamps picturing horrible war scenes: Ukraine "death stamp" depicting "Grim Reaper"; Azerbaijan (food for dead men!); Portugal (slaughter of an army); Bulgaria (soldier with drawn bayonet); Norway (battle scene one thousand years ago); also modern nations at war—China, Poland, Mongolia; many others. Extra for promptness: Pocket stock book and scarce set from Asiatic war countries, cataloging over 50c! All for 5c to approval applicants! Jamestown Stamp Co., 227 Wellman Bldg., Dept. 5, Jamestown, New York.

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BIG PACKET free! Scarce Hindenburg Zeppelin which exploded mid-air. World's smallest Triangle. Indo-China air-mails. Eagle and lion in mortal combat on new Italian East African. Mozambique giraffe. Liberian antelope. 55-year old Eastern Roumelian! Canadian Coronation and Silver Jubilee. Giant diamond-shaped stamp. Holy Lands packet. These and many more in this thrilling package. To approval applicants only 5c. Frederick Fitts Company, Framingham, Mass.

GIFT Edition stamp annual free. Sixty pages with hundreds of illustrations featuring Canadians, Newfoundlanders, United States, Colonials, foreign, supplies. Sent free. Gray Stamp Co., Dept. PR, Toronto, Canada.

COUNTRY Complete! All stamps of White Russia positively complete only 3c to approval applicants. Cactus Approvals, Box 1870-D, Tucson, Ariz.

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YOUR ad in these columns will stick out, get more attention, if you use white space as shown here. Yet the cost is little more. For details, address Classified Ad. Mgr., 11th Floor, 353 Fourth Ave., New York, N. Y.

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CANNIBALAND—British Solomon Islands, genuine Baden, Liberian Bongo, fantastic Manchukuo, Cayman Islands beauty, \$5.00 U. S., Bizarre Negri Sembilan, Turks Caicos. Everything 3c with approvals. Viking, 1-P Hanson Place, Brooklyn, N. Y.

XMAS Present to you! Free. Any 15 stamps you select from our Xmas Approval. Just send names and address 2 active collectors and 3c postage. Ranger Stamp Co., Box 2547, Dallas, Texas.

COLLECTORS. Fine United States airmails, commemoratives, postage on approval. No premiums. Just fine stamps. Harvard Stamp Company, 318 Harvard St., Brookline, Mass.

ALBANIA. Going, Going, Gone! 11 different stamps, 2 complete sets, only 5c to approval applicants Kravat Co., Dept. S3, 1925 Quentin Rd., Brooklyn, N. Y.

SEE for yourself! 20 Different commemoratives. Also U. S. packet. Everythl. 3c with bargain approvals Dolve, Box 406E, Minneapolis, Minn.

GILBERTS Coronation set on cover 10c only with approvals. Jansen, 14 Morland Road, Croydon, England. Business as usual despite war.

ELUSIVE Imperforate triangular miniature sheet with 100 different stamps—10c. Friendly Philatelists. Box 4428P, Philadelphia, Penna.

146 BOSNIA, Bulgaria, Honduras Puerto Rico, Paraguay, Serbia, Siam, Turkey, Trinidad, etc., 10c. Lufbery, Middletown, Conn.

SIX dollars for 9c! 300 different stamps (Cat. price \$6.00) only 9c with approvals. Tatham Stamp Co., Springfield-50, Mass.

GAMBLE. Huge auction purchases broken into \$1.00 lots. Enormous value. Worldwide testimonials. Hughes, Queens Rd., Bournemouth, England.

50 DIFFERENT, fine U. S. including perforation Gauge, 10c with approvals. The Stamp Shop, 813 Holland Building, St. Louis, Mo.

FREE! Royal visit packet. Postage 3c. Roberts, 312U Shearerbldg., Baycity, Mich.

FREE gift with dollar purchase. Ask list. Jem Stamps, Port Jefferson, N. Y.

50 FREE, Iraq, Iran, etc. Postage, 1c. Album 3c. Bullard, 268D Northampton, Boston, Mass.

21 FRENCH Colonies, pictorials, sets of 5 each (105) for 35c. French, 241 Euclid, Cleveland.

BRITISH Colonials, 50 different free to approval applicants enclosing postage. "Crescent Stamps," London, Canada.

UNPICKED mixture; pound 40c. 100 U. S. revenues on documents—10c. (700—50c). Vanvoorheis, Hyndman, Penna.

SET Bulgaria national products 10c to approval applicants. Behrendt, Glastonbury, Conn.

1000 MIXED Foreign, 25c. Well worth sorting for values. Plaza Stamp Co., Santa Fe, N. Mex.

SCARCE Spanish ship triangles complete 8c with approvals. Midwestern Syndicate, 2167 Lakewood, Detroit, Mich.

1000 MIXED U. S., 15c. Foreign approvals. Premiums. Lee, Bridgeport, N. Y.

TEN Different United States, over 40 years old, 10c. Elzea, Bowling Green, Ohio.

25 DIFFERENT Poland 5c approval applicants only. Quality Stamps, Englewood, Colo.

COMPLETE Set, Diamond Airmails, 3c with approvals. Gordon, Box 201, Clifton, N. J.

ICELAND, Guatemala, Mexico, Paraguay, Peru, approvals Zimmer, 722 Culver Rd., Rochester, N. Y.

\$10.00 STAMP Free to approval applicants. Boote, 309 Greeley, Webster Groves, Mo.

5 SETS, premiums and packet 3c with approvals. Mailmart, Box 27, Grand Central, New York, N. Y.

CENT-HI Penny approvals are economical. Ransom, 1333 Pontiac, Ann Arbor, Mich.

22 PRECANCELS from 22 cities 3c with precancel approvals. Gierhart, Baltimore, Ohio.

FREE! 20 different Canada to approval applicants. Hunziker, Box 225-OP, Minneapolis, Minn.

NUDE Duchess (Spain) Hindenburg Zeppelin, 5c—approvals. Laurence Shultes, Berne, N. Y.

50 DIFFERENT Foreign for stamp approvals. Ideal Stamps, 11 Main, Zanesville, Ohio.

25 JAPAN 3c with approvals 1/4c up. Josip Babcock, St. Joseph, Mich.

U. S. Mission mixture—50c pound. Stamps, Box 64, Racine, Wis.

PENNY Approvals by countries. Turbyfill, 513 West 29th, Norfolk, Va.

33 DIFFERENT Airmails, 10c, approvals. Plank, 3164 34th St., Astoria, N. Y.

100 DIFFERENT Portugal 25c. Approvals. LC Trading, Box 38P, Bellerose, N. Y.

300 DIFFERENT 20c; 1000 75c; 2000 \$2.50. Fred Onken, 630 79th St., Brooklyn.

PENNY Approvals that please. Haywood, 395 Adams St., Pomona, Calif.

U. S. Commemoratives—45 different, 25c. Crystal Stamp Co., Racine, Wis.

150 GOOD mixed foreign stamps, 3c. Elvin Stanton, Niantic, Conn.

BRAZIL, 50 different 10c with bargain approvals. Davis, Silver Lake, Ind.

THREE sets for three cent stamp! Jack Reed, Houtzdale, Penna.

PENNY Approvals, that satisfy. Neil Gronberg, Box 5441S., Philadelphia, Pa.

LIBIA—10 varieties 6c with approvals. LeDuc, Saint Petersburg, Fla.

FREE—\$2.00 U. S. to approval applicants. Groh, 95 W. 183 St., New York City.

60 PICTORIALS, etc., 10c; approvals. Edagar, 108 Maple, Windsor, Ontario.

FREE—25 Different Japan with approvals. Lincoln, 5535 May, Chicago.

SURVEYING INSTRUMENTS

FACTORY Rebuilt transits and levels for sale or rent. Cash or easy terms. We will repair, trade in or buy your old instruments. Write for list PS-49, Warren-Knight Co., Manufacturers of Sterling Surveying Instruments, 136 North 12th St., Philadelphia, Penna.

TATTOOING SUPPLIES

TATTOOING. Engraving. Outfits. Illustrated list free. Percy Waters, Anniston, Ala.

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GLASS eyes, Taxidermists', Furriers' supplies. Big catalog Free. Elwood Company, 228 Smith Bldg., Omaha, Nebr.

WOLF Rugs—open mouth; \$12.50 prepaid. Strange's Taxidermy, Clarkston, Wash.

TOBACCO

"KOOLPUF" The scientific pipe Free information. Lock, 1476, Washington, D. C.

TRAPPERS

TRAP fox or coyote: Bunch system gets the slyest furbearer. Results or no pay. Q. Bunch, Welch, Minn., Box T.

TYPEWRITERS, OFFICE DEVICES

TYPEWRITERS, adder, mimeograph, multigraph, addressograph. Send for free lists of machines that will help you at half price. Pruitt, 28 Pruitt Bldg., Chicago.

WANTED—MISCELLANEOUS

CASH for used Scientific instruments, microscopes, cameras, binoculars, etc. Write details. Elman's, 2300-PS VanBuren, Chicago.

WATCHES

WATCH-REPAIRING is steady profitable work. Experts always in demand. You can learn watchmaking trade at home, spare time. New original instruction system. Script engraving course included. Write for free details today! Nelson Company, N-2005 Manhattan Building, Chicago.

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D.C. Arc-welder plans \$1.00 each. (Three for \$2.00). Build your own from Farm light plant generators or northeast Dodge 12 volt generators or D.C. truck motors. Welders Club, WB-3432 M-Mart, Chicago. (Merchandise Certificates issued).

75-200 AMPERE Arc Welders from Dodge generators. Complete plans 35c. 100 other generator changes. LeJay Manufacturing, 323 LeJay Bldg., Minneapolis, Minn.

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HAND PUMP FOR TARGET-SMALL GAME-CAMPING-ETC.

Guaranteed-Accurate-Practical-Economical-Safe-Clean-Quiet. Adjustable Force—Amazing Maximum Velocity. No smoke or fumes. **Bolt Action-Hammer Fire-Hair Trigger-Safety Lock-Hand Pump.** Single Shot BR \$8.50; Single Shot cal. 177 or 22 with rifled barrel \$8.50; BR 8-Shot \$10.00; Holster \$2.00 **Also a complete line of Benjamin Genuine Compressed Air Rifles for BB and cal. 177 or 22.** No license required from dealer or factory. **Ask for complete specifications and Free Targets.** BENJAMIN AIR RIFLE CO., 852 Marion St., St. Louis, Mo., U.S.A.

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 we inquired at a bowling match...



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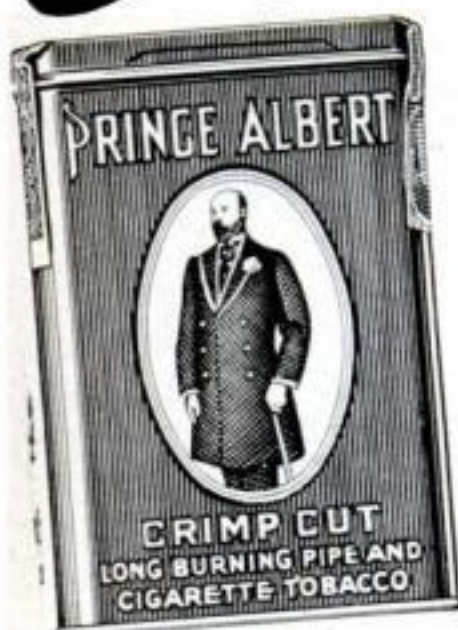
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(Try P.A. in "makin's" papers too.)

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50 pipefuls of fragrant tobacco in
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Prince Albert

THE NATIONAL
 JOY SMOKE





This World War spy warning still hangs in Navy Department offices

G-men are being taught the tricks of spies, such as the match-book code message below



G-Men Go After Spies

IN THE gray stone building of the Department of Justice, in Washington, D. C., 230 picked men from police departments in various parts of the country are being schooled as scientific spy hunters. Under the direction of J. Edgar Hoover, they are mastering the latest technique in outwitting the secret agents of foreign powers. At the same time, 150 new G-men have been added to the staff of the Federal Bureau of Investigation, new offices have been opened up in Hawaii, Alaska, Panama, and Puerto Rico, and Congress has appropriated \$300,000 to aid the scientific sleuths in battling spies. Uncle Sam is girding for a smashing offensive against the legions of espionage.

By EDWIN TEALE

How formidable these invisible legions have become in the United States in recent months is indicated by news flashes from widely separated parts of the nation. To cite but three:

New York, N. Y. Rumors of the existence of an intricate electrical code-scrambling mechanism that would make it virtually impossible for an enemy to decipher wartime messages were confirmed here when Government officials reported blueprints for the invaluable machine had been stolen by the agent of a foreign power.

San Diego, Calif. Navy intelligence officers, becoming suspicious of a closely guarded warehouse, ninety miles from this



To get some secret plans, a foreign spy ring recently plotted to lure a U.S. Army officer into a hotel room or office with the papers and overcome him with a pocket gas gun

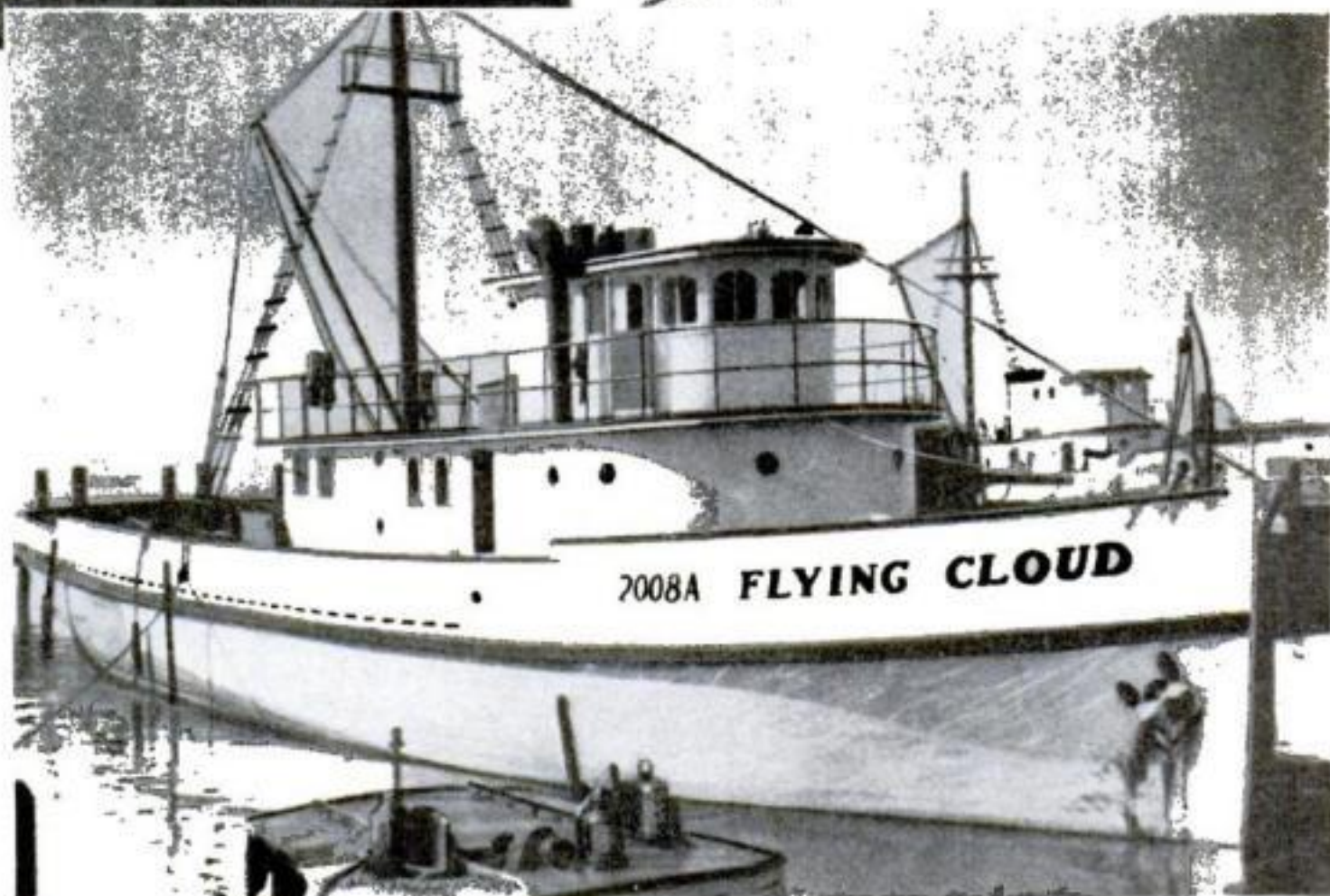
Below is the "Flying Cloud," supposedly a tuna boat. Spy hunters suspected her of carrying acid for sinking warships

key naval base, investigated and found the building contained drums of a peculiar and powerful acid which had been unloaded secretly from a foreign vessel. Dumped into a harbor, the Navy experts declared, the acid would eat metal and damage even cruisers and battleships.

Washington, D. C. According to Attorney General Frank Murphy, the Federal Bureau of Investigation, during the twelve months ending June 30, 1939, handled 1,651 espionage cases—virtually a 600 percent jump over the year before. At the present time, espionage and sabotage complaints are pouring in at the rate of more than 200 a day.

Add to the above the theft of the Air Corps code book at Mitchel Field, N. Y.; the report of serious sabotage aboard the first-line battleship, *Arizona*; the arrest and conviction of red-haired Johanna Hofmann and her fellow-conspirators in a German spy ring; and the current expose of underground activities by a nation-wide organization of foreign sympathizers.

In the underworld of war, where such outrages occur, the crime-fighters of the F. B. I.—the same smooth-running organization



which wiped out kidnap gangs, hunted down major bank robbers, and put racketeers behind prison bars—are taking up the challenge of this secret invasion from abroad. All of the 230 men now at Washington are graduates of the National Police Academy, run under the auspices of the F. B. I. They have returned for specialized post-graduate work in spy hunting. On completing the course, they will be scattered throughout the country, to form local links in a nation-wide chain. Co-operating with them will be the 950 crack detectives of the G-man force. And behind them, ready for constant use, stands the most elaborate scientific crime-detection laboratory in the world.

Manned by experts, this laboratory is replete with the latest apparatus. Here,

scientist-detectives, using polarized-light microscopes, X rays, black-light machines, delicate scales, and precision measuring instruments, unearth clues.

In this workshop, the spy hunters now in training are learning the newest scientific aids to trailing and trapping their quarry. They are receiving instruction in deciphering codes, in examining documents, and in using photography and chemistry in their search for evidence.

How many secret agents are concentrated in the United States at the present time is anybody's guess. During the World War there were 45,000 spies, the equivalent of more than three divisions of the American army, active in various parts of the world. Now, more than ever before, the activity of such war ferrets centers around the advances of science.

Trapping secret agents, however, is only half the battle being waged by Uncle Sam's scientific sleuths. Preventing sabotage is the other half. In 1917, during the first sixty minutes after the United States declared war on Germany, there were seven explosions in the factories of a single New England city. The industrial wrecker, the dynamiter of bridges, and the bomber of munitions plants, according to J. Edgar Hoover, is just as serious a menace as the foreign spy seeking carefully guarded military secrets.



Reading between the lines: G-men are taught to use chemical reagents to bring out symbols put in books with invisible ink



Searching the apartment of a suspected spy. At the F.B.I. school, agents learn how to look for evidence that might betray a spy ring



Mischief's afoot when a feminine secret agent uses a hollow heel of her slipper as a hiding place for code messages. A lot of information can be carried this way

J. Edgar Hoover, Director of the Federal Bureau of Investigation, who is in charge of the program for training scientific sleuths to guard America against spies





Signs like the one above inform tourists of the purpose of the golden arrows on the pavements

Arrows Marked on Streets Guide Visiting Tourists



AS AN aid to tourists planning to visit the Old Mission House and other sites of historic interest in Santa Barbara, Calif., municipal officials recently evolved a novel plan of directional signs. On the two main highways entering the city, large signs were erected directing motorists interested in viewing historical spots to follow the "golden arrows." These are directional arrows, marked on the white center lines of the streets in glistening gold paint to make them easily visible. Tourists following the trail are led on a tour of the city's points of interest.

Bag on Car Roof Holds Gas Fuel

ALTHOUGH it looks as though a motorist planned to make a balloon ascension with an automobile serving as a gondola, the photograph below shows an English car whose motor has been adapted to run on either regular gasoline or coal gas. The fabric "balloon" on the car top serves as a reservoir for the coal gas, whose use as a motor fuel may become general in Great Britain to conserve gasoline.



Gasoline shortage notwithstanding, this car has its fuel "in the bag"



Novel Advertisement Proves Its Point

To demonstrate the superior heat-conducting qualities of copper-plated cooking utensils, a store display card has two thermometers joined by a half-steel, half-copper-plated bar. When a flame is held at the bar's center, the thermometers prove the point.

Brake Springs Easily Replaced with New Pliers

REMOVING and replacing internal brake springs in automobiles, usually a difficult and time-wasting job, is now greatly simplified by the use of specially designed pliers just placed on the market. Fitted with a pointed set screw on one jaw which grips the lining, and a hook on the other jaw which holds one end of the spring, the tool makes it easy to pull the spring into place with one hand. It is claimed that the pliers enable a mechanic to finish a replacement job in about one half the usual time.



A set screw grips the brake lining, while a hook pulls spring into place



Trout Caught in Street Drain

EXCELLENT trout fishing through a street drain—that is the break that Wautoma, Wis., anglers get, since the cold waters of the White River flow at one point through a cavern below Wautoma's Main Street. All that local fishermen have to do is lift the drain grating, drop in a line, and haul out a nice mess of trout. In the photograph, a Wautoma sportsman is landing a fish.

Bottle Wiper Removes Condensed Moisture

MOISTURE that collects on chilled beverage bottles when they are removed from a refrigerator can be wiped off quickly and easily before the drinks are served, with a novel wiping device now available. As shown in the photograph at the right, the wet bottle is drawn through the center hole in a disk of soft, flexible sponge rubber, and the bottom is then wiped across a rubber squeegee on top of the unit. Four suction cups hold the device firmly to any smooth surface. The wiper is designed both for home and for refreshment-counter use.



The sponge-rubber disk wipes the cold bottle dry



Fireproof Cotton Mattress

TO PROVE that a new type of treated cotton is fireproof, a Texas manufacturer recently built a fire on top of a mattress made of the cotton and covered with fire-resistant ticking. The mattress failed to ignite and the ticking was only slightly scorched. The new fireproof cotton can also be used as an insulating material for buildings.

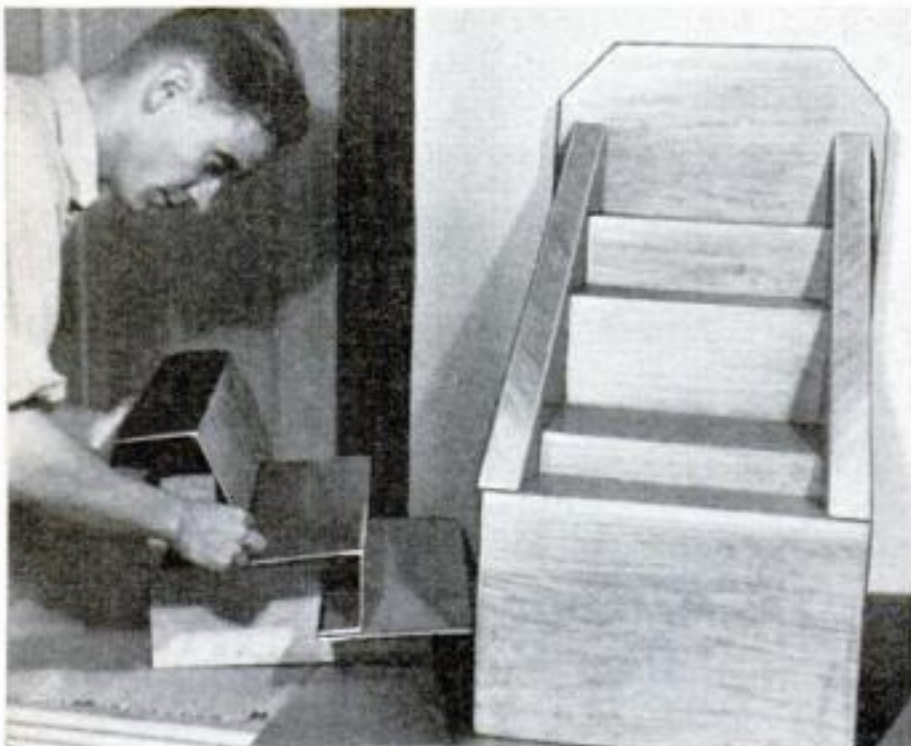
Chart of Fur Facts Aids Customers

DETAILS of the fur coats on sale are furnished to customers of a New York City furrier by the advertising device pictured below. When a disk is turned so that the name of one type of pelt appears in a window slot, other slots show the cost of a coat, value of pelts, and other pertinent facts.



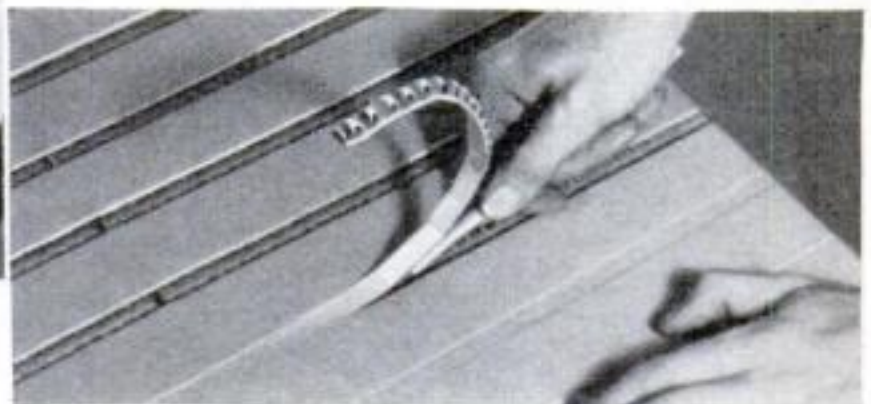
When the disk is set for a given fur, information about the fur comes into view

Display Board Bends Without Cracking



A pencil or screw driver inserted under the V-shape cuts lifts out a strip. The cardboard then can be folded smoothly along the groove

V-SHAPE cuts in a new type of display board now on the market make it easy to shape the material into columns, steps, and other forms useful in making backgrounds for store displays, amateur theatricals, and photographic studios. Bevels cut into the cardboard allow strips to be removed, thereby providing cut-away spaces along which the cardboard may be folded without cracking.



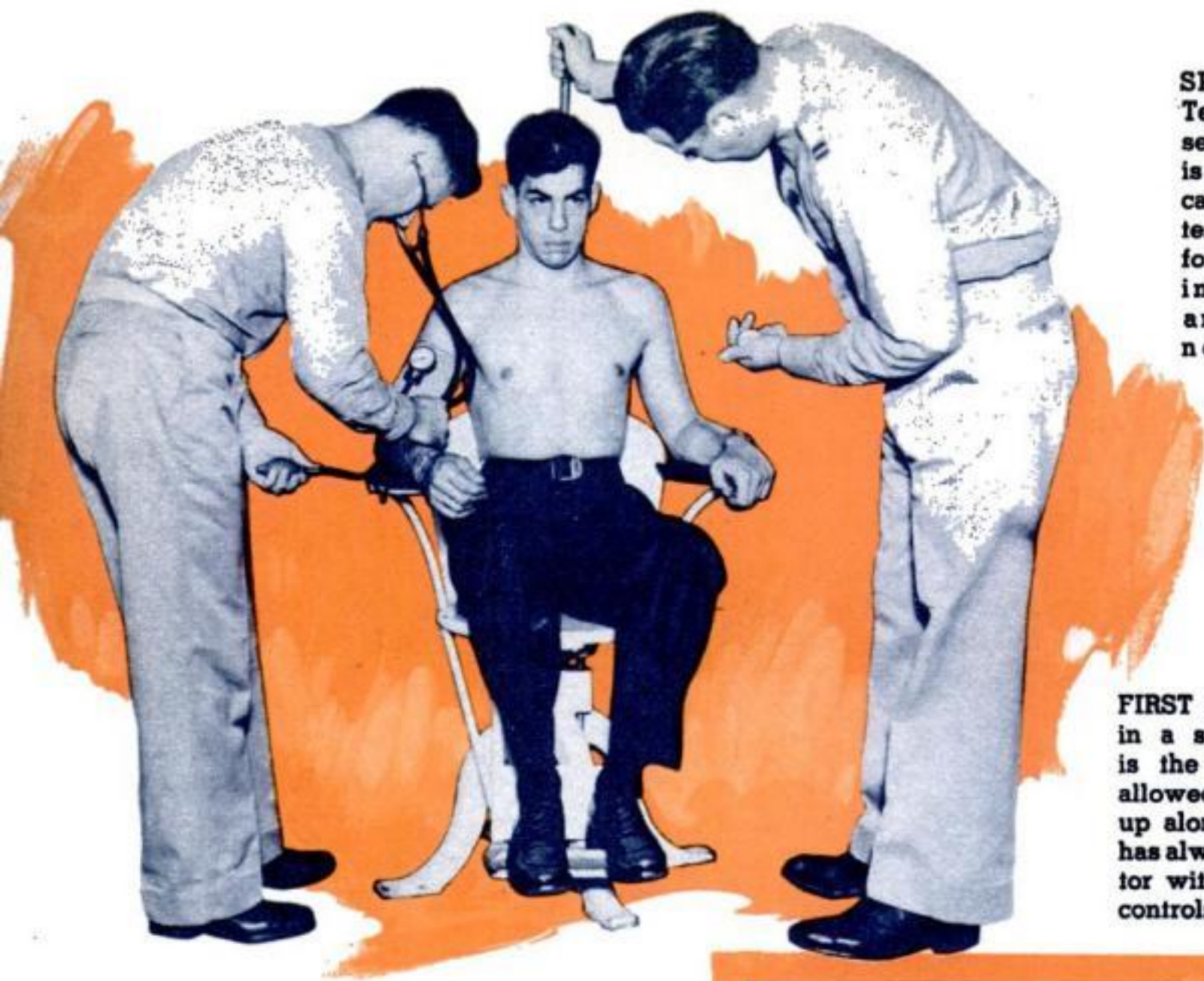


Beginning and end of the training of an Army pilot. First flight with an instructor in a dual-control plane; left, he receives the coveted silver wings from his best girl in the good old Army tradition

MAKING OF AN Army Flyer



THESE PAGES TELL THE TRUE STORY
OF THE TRAINING OF AN AIR CADET



SPINNING CHAIR
Testing an applicant's sense of equilibrium is part of the physical examination. The test chair is rotated for several seconds in each direction, and the doctors note reactions

FIRST SOLO. High spot in a student pilot's life is the first time he is allowed to take a plane up alone. Before this, he has always had an instructor with him at the dual controls while in the air

By STERLING GLEASON

"**C**LOSE your eyes," said the Army doctor.

Rick Jones leaned hard against the head rest as the test chair began to spin.

"Twenty seconds. Reverse." Hands slowed the motion, sent the chair turning in the opposite direction.

"Time up," said the doctor. "Now look out the window at that tower just beyond the hangar."

Rick tried to focus but his whirling brain kept pulling his eyes to the left. He could feel them jerking rhythmically from side to side. The doctor was watching and, at their final twitch, clicked a stop watch.

"Twenty-three seconds." The assistant made a note.

In the big examination room, other men were behaving queerly. One was climbing onto a short stool, then down again. Five lay on bunks with instruments strapped to their arms while doctors read pulses, blood pressures, and heartbeats. As in a crazy dream, Rick found himself sitting naked on a



A few of the PT-13 training biplanes "on the line." Cadets get their first taste of flying in these standard dual-control ships



chair. He was tapped sharply with a rubber hammer on the arm, wrist, and just below the knee. Then a series of rapid commands:

"Shut your eyes tight. Bare your teeth. Wrinkle your forehead. Stick out your tongue. Make faces. Whistle."

A pause. Then, "Reflexes O.K."

Finally Rick was sent down the hall to a darkened room where another doctor handed him two long cords running to a pair of vertical black rods dimly visible across the room.

"Line the rods up even," commanded the examiner.

A couple of trials. Then tests with distant black lines, bright spots of light, jumbled print; with a headset that gave out faint musical whistles, tuned to the pitch of the air-line radio beam. A long chat with a friendly officer who asked about his family, his boyhood and schooling, his aviation interests from the time he was a youngster haunting local airports and building model planes, to the summer he spent as a "grease monkey" at a

metropolitan flying field near his home.

When the officer shook hands and wished him luck, Rick realized that his mental processes had been studied as carefully as his physical reactions. He walked out past the rows of glass-walled steel hangars where men were working busily over motors. Over on the line stood three enormous twin-motored planes. On their noses was painted, "11th Bombardment Squadron," and beneath, the insignia — a picture of "Jiggs" carrying a bomb under his arm.

In the courtyard, a soldier stood before a giant megaphone mounted on a post. He raised a bugle to his lips. Through the megaphone, mellow but commanding, sounded a call, and toward hangar and shop came cadets in little groups, natty in their slate-blue uniforms and jaunty flight caps.

Would he, Rick Jones, ever be part of this giant air fleet, a major arm of the defenses on which the United States rests her hopes of security? Then he remembered that Uncle Sam wants thousands of trained pilots at once; wants them badly enough to give free a

Insignia of the 11th Bombardment Squadron





**RANDOLPH FIELD, ARMY
UNIVERSITY OF THE AIR**
Goal of Uncle Sam's fledgling
pilots, this city of 4,000 is de-
voted exclusively to training



\$20,000 course under top-notch instructors in the world's finest aviation school; and sugars it off with seventy-five dollars a month pay, plus all expenses, while learning. Then the silver wings of an Air Corps pilot and a second lieutenant's commission. Finally, the choice of a five-year tour of active duty at

IT ISN'T ALL FLYING
In ground-school shops, expert mechanics explain the ins and outs of high-powered engines

one of the Air Corps' many tactical stations throughout the United States and its possessions, leading eventually into an officer's career. Or else, the right to step out into the aviation world as an experienced, Army-trained pilot.

What a chance! On his way home, Rick wondered whether he could stand the suspense of waiting.



GETTING READY

Here an instructor is checking up on the adjustment of a student's parachute harness just before he takes off on one of his first solo flights

WAR BIRDS IN THEIR NEST

In the school hangars, a cadet learns all about a modern fighting plane. The low-wing mono-planes below are the BT-9's used in the second training period



"**H**ERE y'are, young Jones," grinned the mail man, two weeks later. Rick's anxious fingers ripped open the long, brown envelope.

"Report to the recruiting office nearest your home for enlistment. Three days allowed to prepare yourself—"

He stood in the recruiting office and took the oath, signed his name on the register, and went on Uncle Sam's pay roll as Flying Cadet Rick Jones. And within a week after his arrival at one of the country's nine primary training schools, he was actually flying. Three hours a day went for ground-school classes in radio, aerodynamics, gunnery, navigation, air regulations, military procedure, and engines. The balance of the day found him usually in the rear cockpit of a PT-13, standard training biplane, with his instructor at the dual controls in the front seat. Out into the country they would go, fifteen or



Practice in regular infantry drill teaches cadets the fundamentals of military conduct



Helmeted students get last-minute instructions before going to their planes to take off on one of the many practice hops from the school



EYE TEST. A good pair of eyes is an essential part of a pilot's equipment. Here an applicant is undergoing a test that reveals defective vision



BALANCE. By trying to keep this pivoted chair on an even keel with his eyes closed, a would-be student flyer soon shows whether or not he has a reliable sense of balance

twenty miles. Heading toward one of the numerous emergency landing fields, Rick would push gingerly on the stick and drop into a slow glide to "feel" for the ground—always with the reassuring touch of the instructor on the dual controls.

Gradually he lost the sensation of the ground rushing up to meet his landing wheels. Then, one day, the instructor stepped out and remarked, casually, "Now you take it around for a turn."

Cadet Jones's heart skipped a beat. Solo!

He swallowed hard, gunned the motor, sent the ship racing swiftly down the field and upward in a smooth climb. The field below shrank as he climbed to 300 feet, made a ninety-degree turn, and, still rising, traced a wide square and again dipped the nose of the PT-13. Up rushed the flat earth to meet him and he realized he was moving nearly two miles a minute. In the empty front seat he missed the reassuring profile of his instructor and suddenly his knees went weak. But the field was approaching rapidly. Automatically Rick cut the gun, eased forward on

the stick, made a gliding turn, and saw the boundary of the field flash by. Just at the last moment he leveled off, felt the landing wheels bump, and came sailing smoothly to a stop, not ten feet from where his watching instructor stood on the side lines. Rick repeated the brief flight twice more before he finally taxied up to his instructor and came to rest.

"Good landing!"

Rick saluted and opened the flight record book to enter a report of his morning's work. "Name of pilot, number of passengers, time and place of take-off and landing; functioning of controls, flying qualities of plane—"

As he sought to fill in the blanks, the lines of print ran together. Cadet Jones suddenly felt his pencil wobbling so he could not write!

METALLIC and shrill through the headset came the instructor's precise tones:

"The chandelle is an exaggerated climbing turn. The plane completely reverses



FORMATION FLYING WITH THE PT-13'S

To prepare pilots for modern aerial warfare, in which battles between massed planes have replaced single combat, the cadets are taught to fly in formation. At right, two students are watching a demonstration by instructors. Later, they will try it themselves



its direction of flight—"

All he had read of aerial dog fights, of planes flashing in silver loops and spirals, of the hallowed names of Rickenbacker, Guynemer, and Richthofen, flashed through the mind of Cadet Jones, and pleasant prickles of anticipation played along his backbone. Acrobatics!

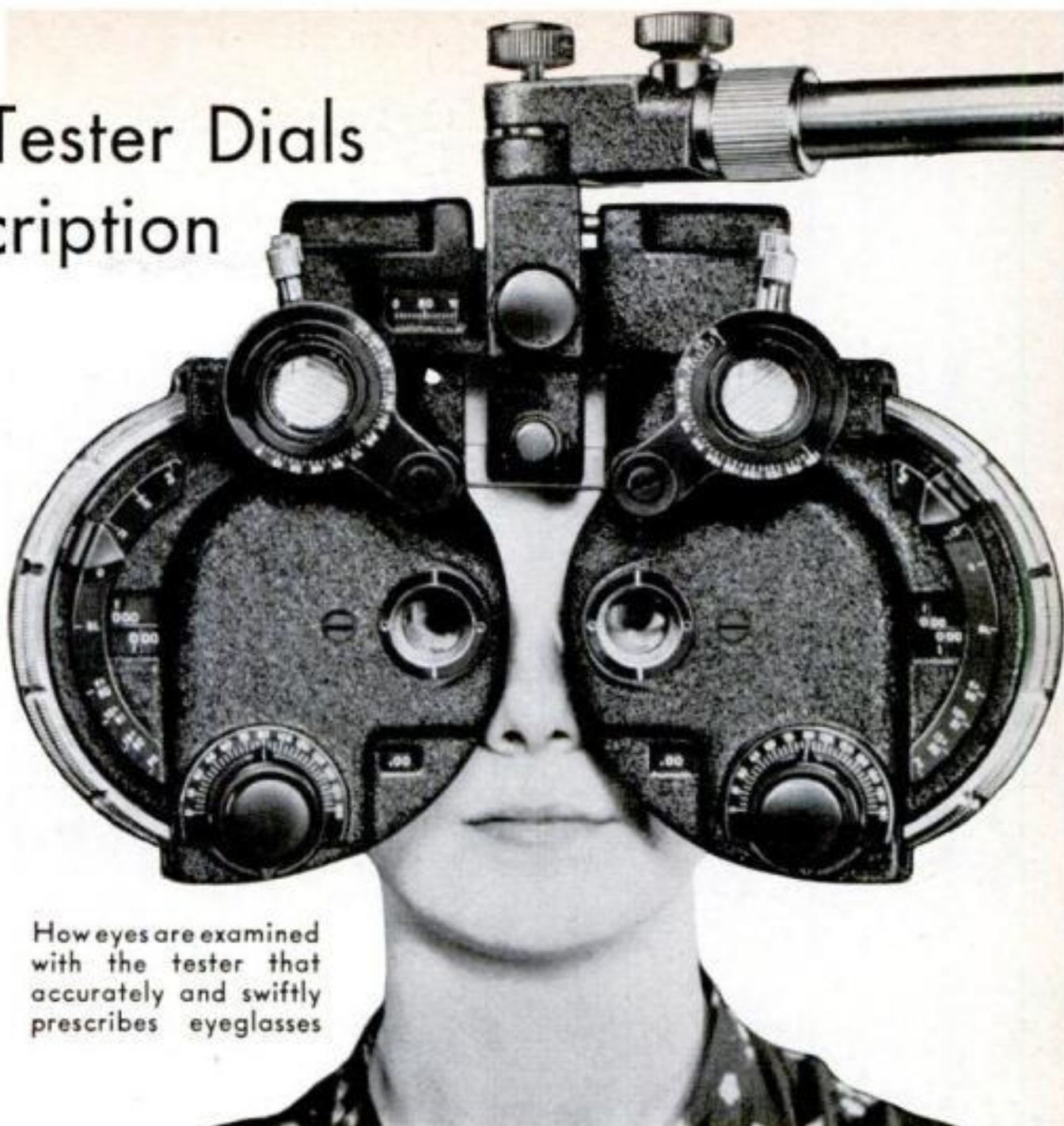
"We begin at maximum speed in a shallow dive; gradually dissipate that speed as we turn and climb, until we have completely turned about and are flying again at a safe minimum speed. Follow me through and I will execute a chandelle."

The dual-control stick pulled at Rick's hand as the instructor sent the nose dipping, then gently brought it back, simultaneously applying right rudder.

"Notice," continued the voice, "that in this maneuver the controls are never set, but are moving all the time. A firm but gentle touch is necessary for a smooth execution." The ship's *(Continued on page 230)*

New Eye Tester Dials Your Prescription

THOUGH it contains only thirty-six lenses, a new aid in fitting eyeglasses can reproduce more than 61,000,000,000 different prescriptions. Heretofore it was necessary to slip different lens combinations, by hand, into a spectacle frame until a satisfactory prescription for the wearer was found. The new device, called a phoropter, is declared to perform the same task in a fraction of the time and with considerably greater accuracy. As shown in the accompanying illustration, the completely self-contained apparatus is swung out by means



How eyes are examined with the tester that accurately and swiftly prescribes eyeglasses

of an adjustable bracket in front of the patient's eyes for the examination. By manipulating dials and knobs connected to the batteries of test lenses, the operator can place an almost infinite number of lens

combinations before the eyes with amazing rapidity. An ingenious mechanism within the instrument automatically adds up the individual lens powers and records the total correction on an indicator.



An air-raid-protection peddler in London

Keeping It Dark Is His Business

BLACK-OUTS in England, the hiding or extinguishing of all lights for protection against night air raids, created a new line of business for an enterprising street vendor. Going from house to house with rolls of dark fabric and tools for applying it, he was kept busy fitting windows with the light-proof covering.



Loop Hook Protects Sweaters

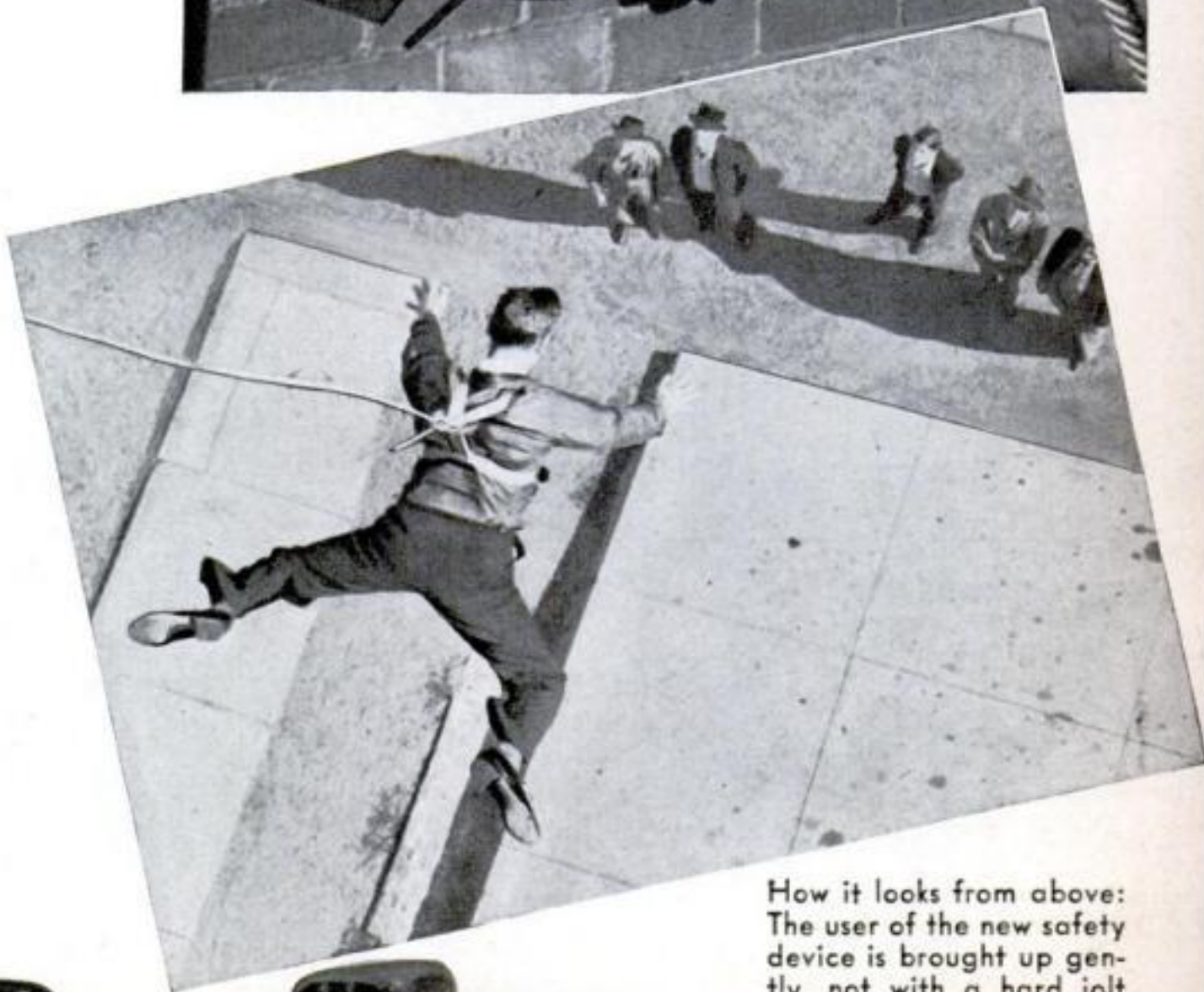
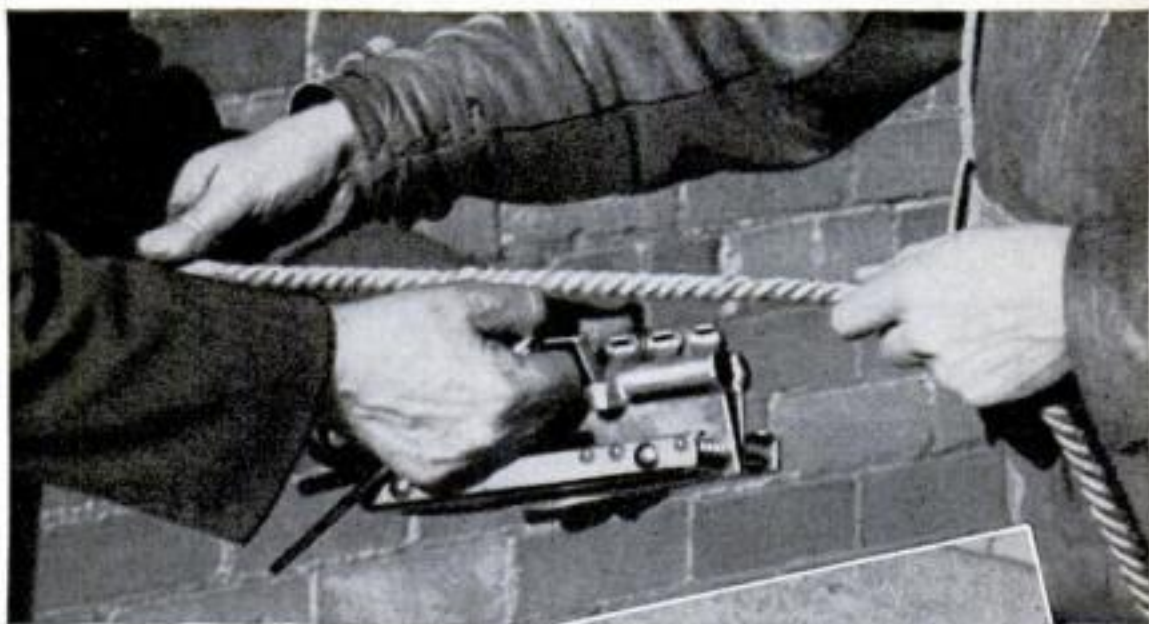
BUMPY marks left by ordinary clothes hooks are avoided when a sweater is thrust through the loop of the hanger shown above. The ornamental fixture of brass, designed to resemble a riding-boot spur, also provides hooks for a coat and hat.

Life-Line Shock Absorber Breaks Worker's Fall

FROM the top of a six-story tower, a man leaped into space. Spectators gasped—and then saw him brought up dangling in mid-air, gently but surely, and drawn back to safety.

What a parachute is to an aviator, the new life line that he demonstrated is to workers in high places. Developed by a Denver, Colo., maker of safety appliances, it consists of a harness fastened to any secure anchorage by a rope passing through an ingenious friction brake. Without the brake, a rope long enough for freedom of movement would end a worker's fall with an injurious or fatal jolt. But in the new safety device the brake clamps down on the slipping rope just gradually enough to stop him without harm.

Leaping from the top of a six-story tower, the man at the left is demonstrating the new life line for workers in high places. Below we see the ingenious friction brake that slowly clamps down on the rope



How it looks from above:
The user of the new safety
device is brought up gen-
tly, not with a hard jolt



Rattle Spreads Raid Alarm

COMPLETELY swathed in protective clothing, rubber boots, steel helmet, and a gas mask, the British air-raid warden in the photograph at the left is shown swinging a large wooden rattle, a noise maker of the type often used in celebrating such festivities as New Year's Eve. If forced by the necessity of donning his gas mask to abandon blowing a warning whistle to spread the alarm of an approaching air raid, the warden can continue to sound the alarm by swinging the clattering wooden rattle.

"Leaded" Steel Cuts Costs

"LEADED" steel, made by adding small amounts of lead to batches of steel, is industry's latest trick to increase the machinability of its products. Leading does not decrease the strength of the steel, but does make it easier to cut and shape. The result is less wear on cutting tools and dies, faster production, and lower manufacturing costs.

New Hoop Cycle Hits Lively Clip

A LARGE rubber-tired hoop is both the body and the traction wheel for an unusual vehicle recently completed by Julius Rose, a Glendale, N. Y., auto mechanic. Fitted with a diminutive front wheel steered by means of handlebars, as shown at the right, the curious cycle is powered by a gasoline engine placed between the operator's legs. The machine is said to travel up to fifty miles an hour and to run 250 miles on one gallon of gas.



Julius Rose testing his novel cycle. It makes 250 miles on only a gallon of gasoline



Three miles up, plane passengers enjoy a television program broadcast 200 miles away



The landing, as it appeared on the screen

Passengers See Plane Landing by Television



At the airport, a television camera scans the arriving plane

AIRPLANE passengers over North Beach Airport in New York City recently experienced the thrill of looking into the viewing screen of a television receiver installed in the cabin and seeing the plane in which they were flying glide down to a landing. This was the climax to a round-trip flight to Washington, D. C., where at an altitude of over 16,000 feet, the passengers saw and heard a program televised in New York City, more than 200 miles away, or about 150 miles farther away than the

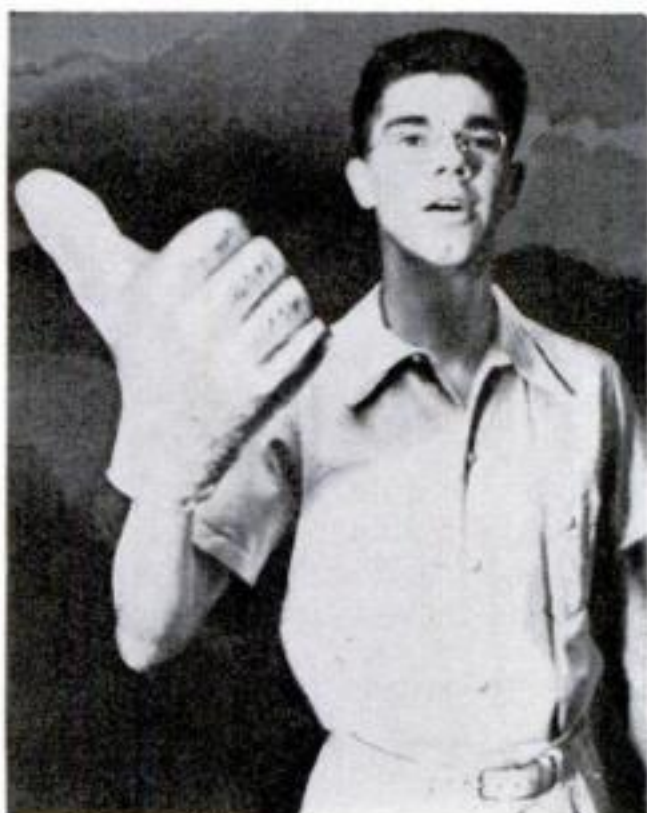
normal ground range of television signals. No television images appeared on the viewing screen over Washington until the plane climbed to the 16,000-foot level, because, engineers pointed out, the ultra-short waves used in television, travel in comparatively straight lines and do not follow the curvature of the earth. When the plane returned to New York, the camera of a National Broadcasting Company television truck scanned the landing scene, and the image was transmitted to the set in the plane's cabin.

600-Pound Cake Used for Giant Soap Carving

WHAT skilled hands can do with a cake of soap, besides using it for washing, is illustrated at the right. Carved by Miss Helen Beling, and entitled "The Spirit of '76," the 600-pound work of art was one of hundreds of pieces of soap sculpture recently exhibited at the Franklin Institute, Philadelphia, Pa.



"The Spirit of '76" carved out of a 600-pound block of soap



Motorists rarely pass this fellow up

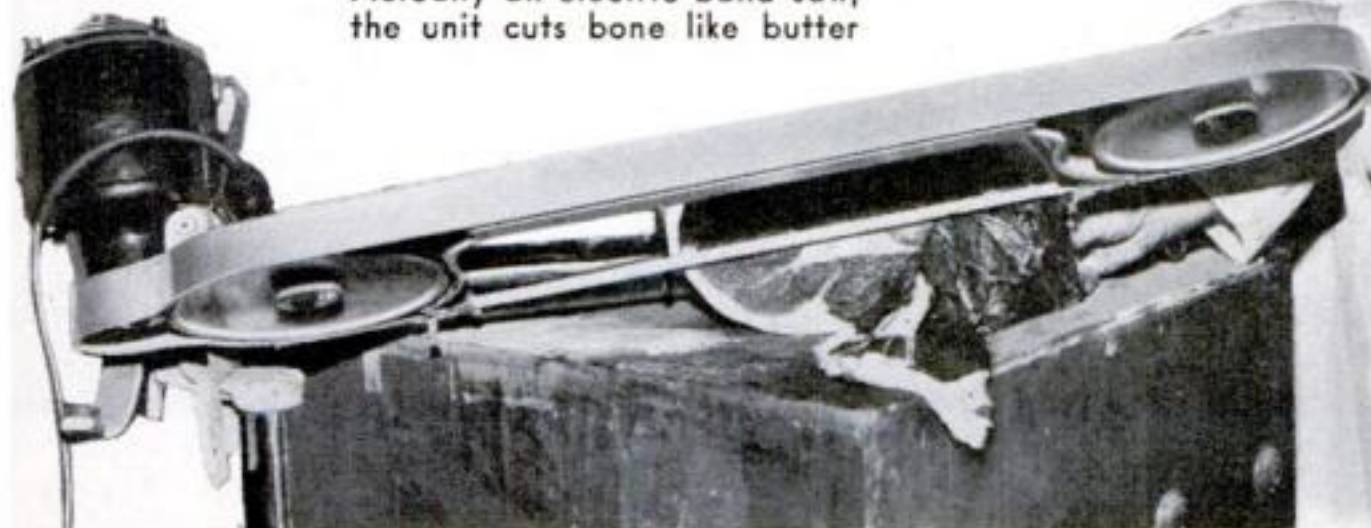
Giant Hand for Hitch-Hikers Thumbs Rides in a Big Way

LAUGHS mean lifts for Robert D. Wassall, resourceful hitch-hiker of St. Louis, Mo. By waving a Gargantuan hand of papier-mâché at passing motorists, he thumbs his way on a grand scale—and more than 100 miles freely slip away between his home and the University of Missouri where he is a student. Confronted by this magnified invitation to take aboard a passenger, any driver of normal curiosity slows down to see what it is. He generally grins when he finds out—and Wassall is on his way.

New Electric Saw Aids Butchers

TO SAVE time and trouble for the butcher, a new electric saw, demonstrated for the first time recently at Chicago, Ill., makes short work of slicing off a piece of meat. When the flesh has been cut in the conventional way with a knife, the power-driven blade of the saw quickly severs the bone. Safety guards inclosing the blade are declared to minimize any possibility of accident.

Actually an electric band saw,
the unit cuts bone like butter



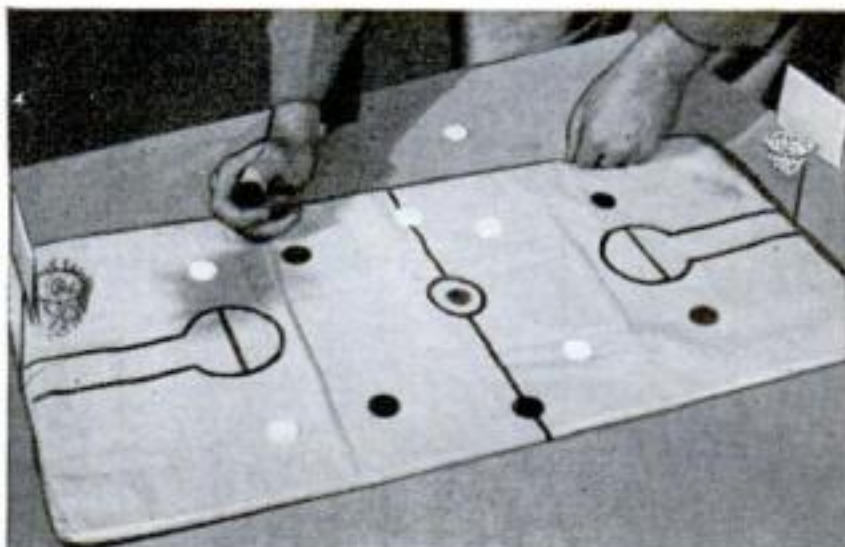


Vaporizer Rests Weary Feet

GRANDMOTHER used to recommend soaking them in a pail of hot water, but nowadays sore, aching feet can be relieved by a special vapor bath, according to the makers of a novel electric unit recently demonstrated in Chicago, Ill. The footsore patient places his feet in a cube-shape container that is plugged into an electric outlet. Soon the therapeutic device is filled with a medicated vapor that bathes the feet and is said to relieve tired muscles, stimulate circulation, and reduce inflammation.

How the electric device is used. Both feet get a soothing treatment that eases aches and pains

Table Basketball Game



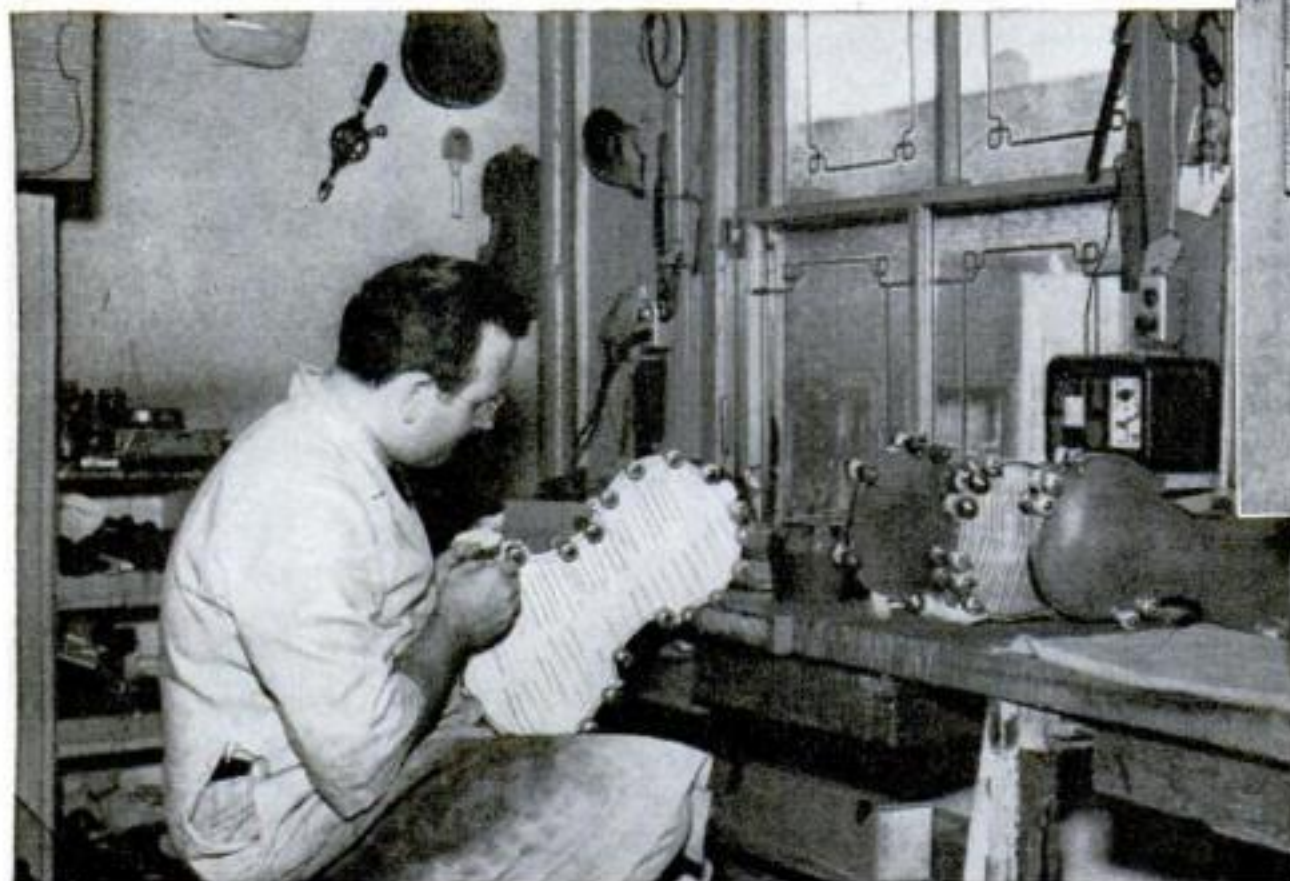
BASKETBALL fans will enjoy this new table game. Colored disks represent players and a sixth chip of each color is the ball. The object is to flip the ball into tiny hoops.

His Violins Rank with World's Finest

MAKING violins that are said to equal the best ever constructed by master violin makers is the accomplishment of William Moenning, Jr., of Philadelphia, Pa. Stringed instruments produced by Moenning were recently judged by experts to be even superior to those made by Stradivarius.



William Moenning, Jr., selecting wood by its tone

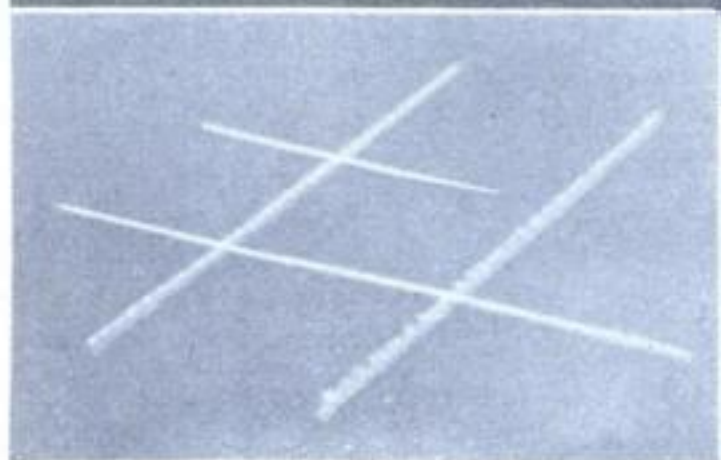


At left, the craftsman puts together a new instrument in his workshop. The wood used is fully a century old

Pilots Play Ticktacktoe in the Sky

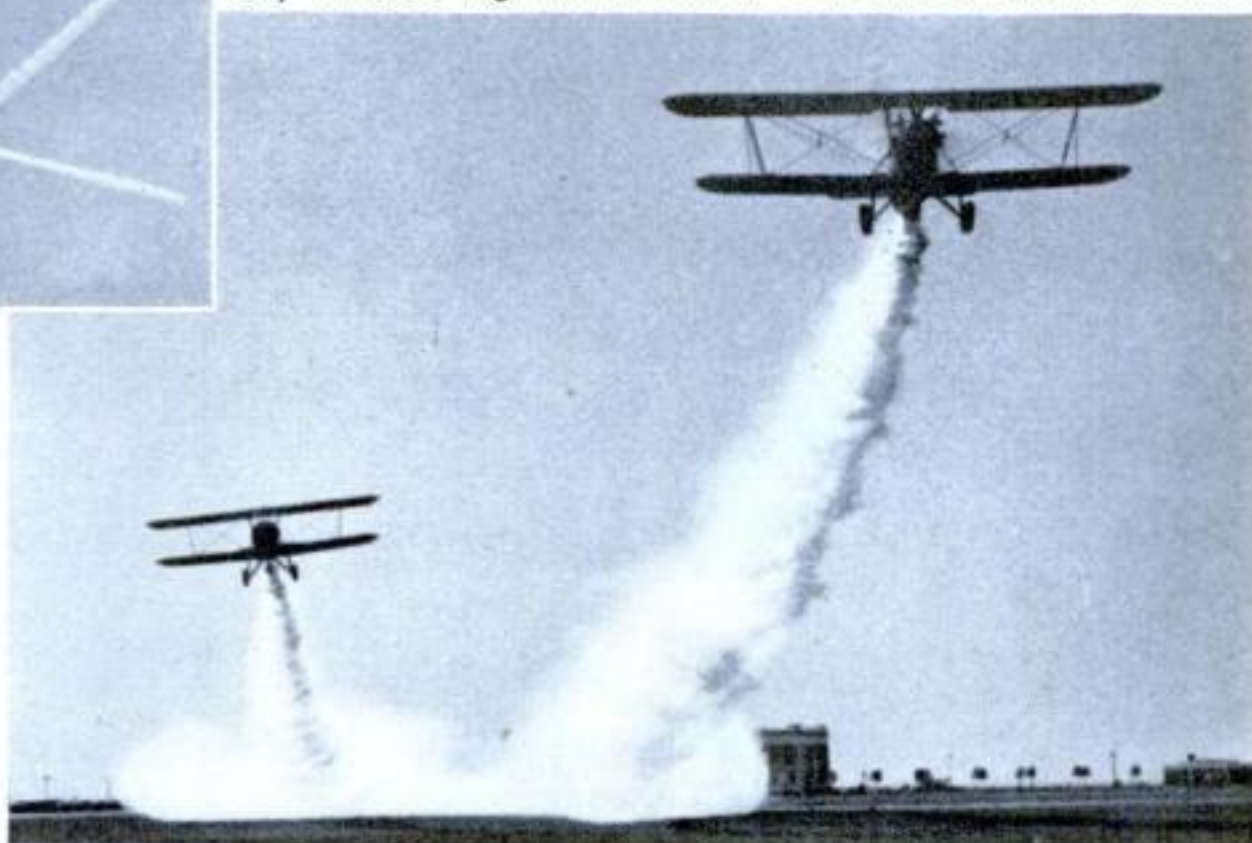


Sky writers using the heavens as a blackboard for ticktacktoe



Beginning their game, the flyers spread the familiar crisscross pattern over ten miles of blue sky. They are shown taking off at right

Between sky-writing jobs, Andy Stinis and Dave de Blasio while away the time at their favorite game on the ground at the airport



WITH the open sky as a blackboard and their airplanes as pencils, Andy Stinis and Dave de Blasio, sky-writing pilots flying from Floyd Bennett Field, in New York City, recently staged a game of ticktacktoe thousands of feet above the earth. Spreading their game over ten miles of sky, the pilots formed the familiar crisscross and then filled in the spaces with X's and O's as shown in the photograph at the top of the page. Stinis, using the O, won the unusual game.

Dogs Trained for Polar Expedition



"Mushing" without snow. Left, a pup and a veteran

PREPARING for long treks over broad, barren stretches of ice, the sled dogs scheduled for use by Rear Admiral Richard E. Byrd on his present Antarctic exploring expedition, recently completed a stiff training course at a New Hampshire kennels. One of their exercises was "mushing" a rubber-tired wagon over mountain roads.

Weight Tethers New Baby Exerciser

WHILE furnishing healthful exercise and serving as an aid to learning the rudiments of walking, a novel exerciser for infants keeps the baby within a safe radius of five feet from one spot. Strapped to a sliding safety belt within a framework fitted with handlebars and high side rails, the baby toddles around, partially supported by the caster-wheeled carriage, which is pivoted to a fifteen-pound metal weight, as shown at the right. The latter has a rubber base to prevent it from slipping or sliding. The central weight, together with the long wheelbase of the carriage, gives the unit unusual stability.



Two-Way Radio Timer Aids Announcers

TO PROVIDE the ultraprecision timing required by modern broadcasting studios, a Hollywood, Calif., radio commentator has invented a two-in-one "program clock." Its upper dial reveals at a glance, in minutes and seconds, exactly how long a program has been on the air. A second dial, below, shows just how many minutes and seconds of a program's allotted time remain. At right, the inventor compares his clock with a stop watch formerly used for the same purpose.

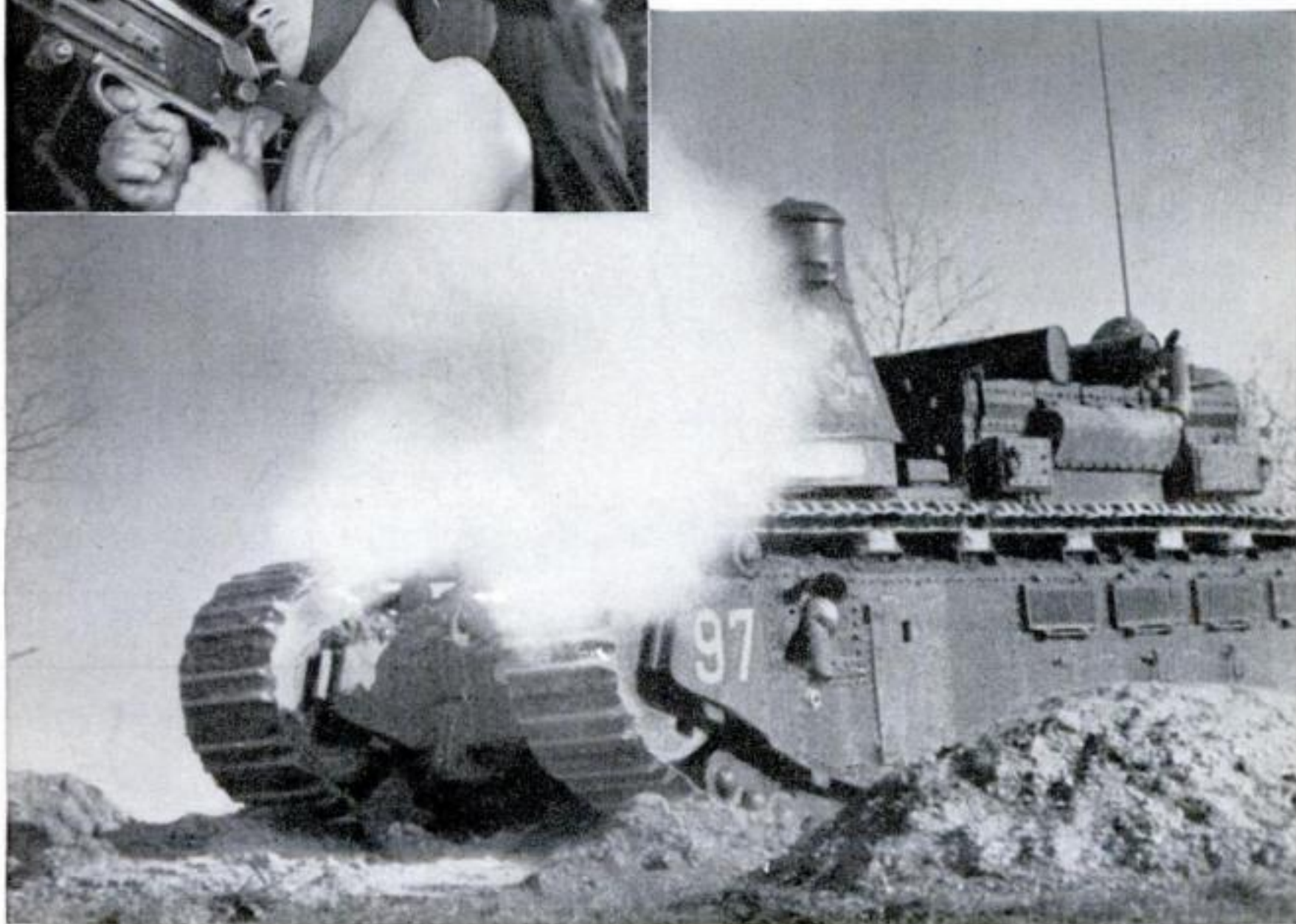


One dial tells elapsed program time, the other time to go

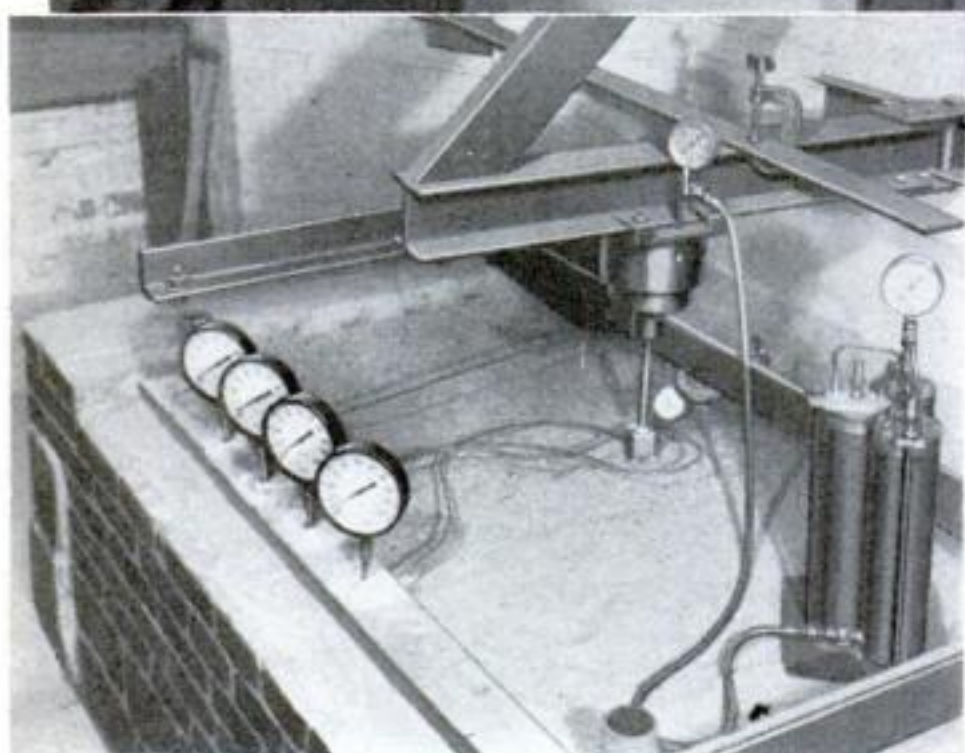
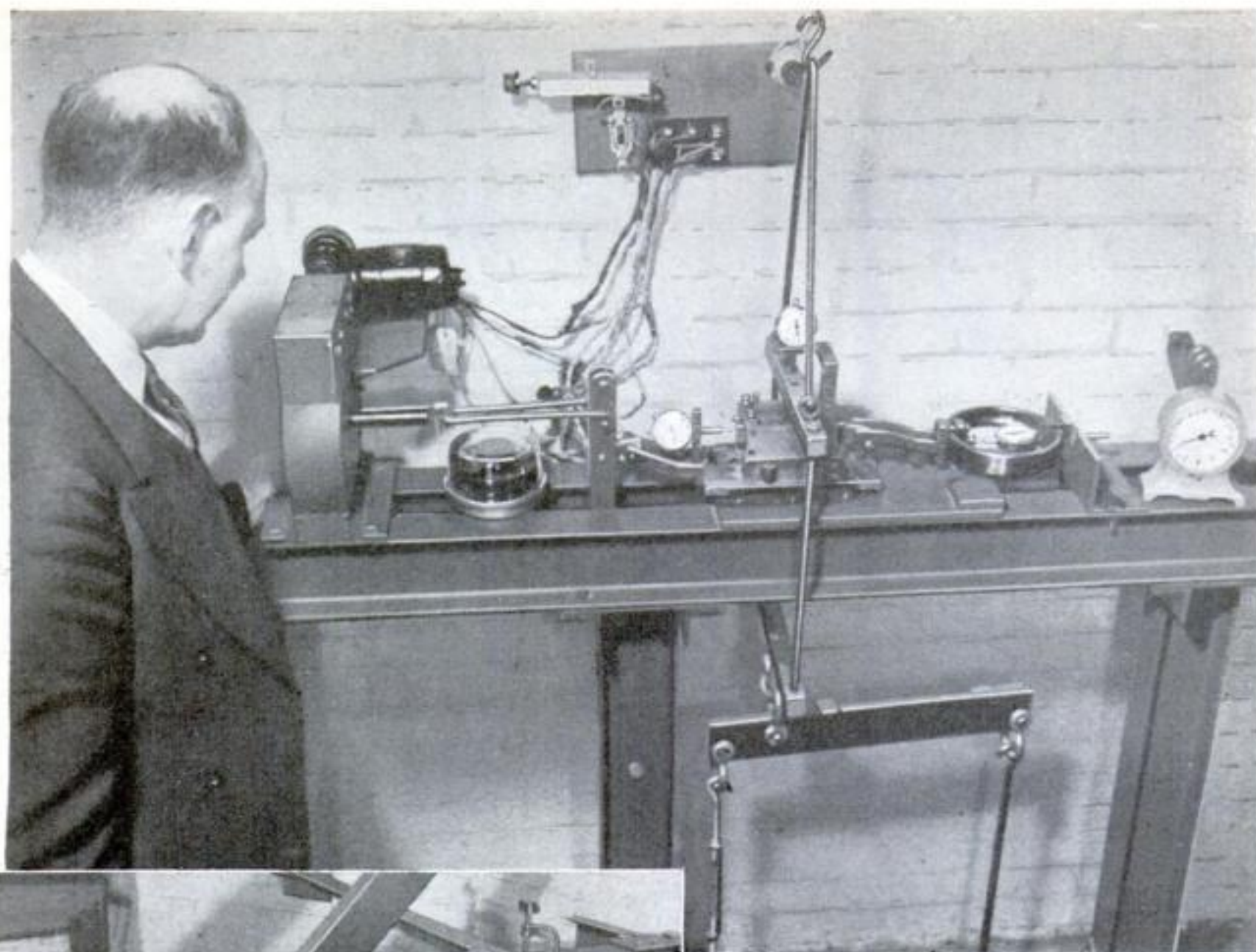
New "Land Battleship" Mounts Big Guns



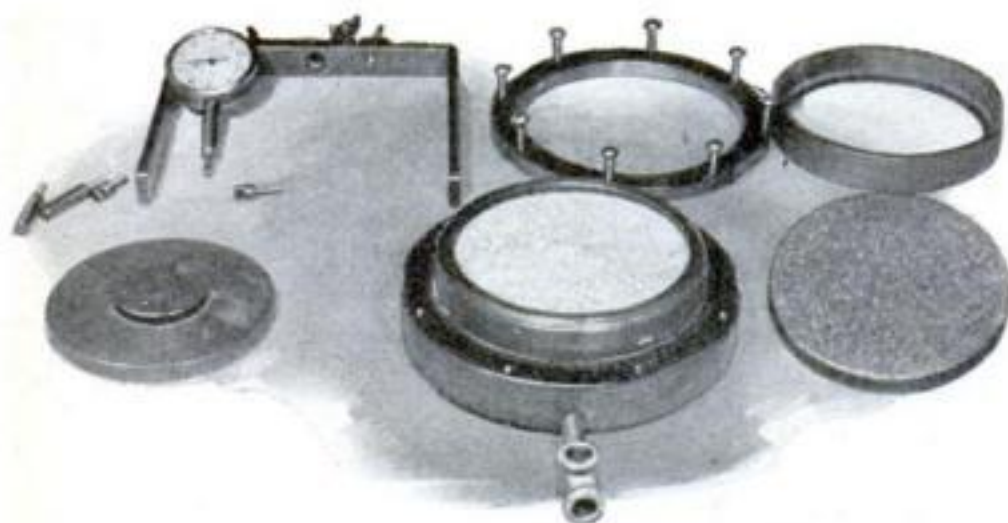
STRIPPED to their waists in the ovenlike heat, gunners within a mammoth tank are pictured at their battle stations, in one of the first photographs to be released showing the interior of a giant French "land battleship." Protected by extra-heavy armor, these mobile steel fortresses are said to mount high-powered guns in addition to their regular battery of machine guns.



One of the new mammoth French tanks in action. The inset shows the gunners at their battle stations



The dials above register the pressure exerted on a pile by surrounding soil at various levels. At top is the apparatus for measuring a sample's resistance to shearing



Soil under test is placed in this cylinder and locked in between two porous sandstone disks. All parts of the testing equipment are made with hairbreadth accuracy

Soils Are Tested for Foundations of Big Buildings

BECAUSE man-made structures are no stronger than the foundation soils on which they rest, the erection of huge skyscrapers, dams, and piers has led to the development of a new science of "soil mechanics" for testing the shearing and compression of the earth under the tremendous weights of gigantic structures. Varying from the simple task of building on the bed rock of New York City's Manhattan Island, to anchoring a heavy structure to the 600 feet of soft mud underlying Mexico City, the problems facing experts in soil mechanics are being met by the use of intricate testing apparatus like that pictured, which are being employed by Prof. Donald M. Burmister of Columbia University, New York City. Besides testing compression and shearing action, the instruments forecast the pressure on foundation piles at various levels.

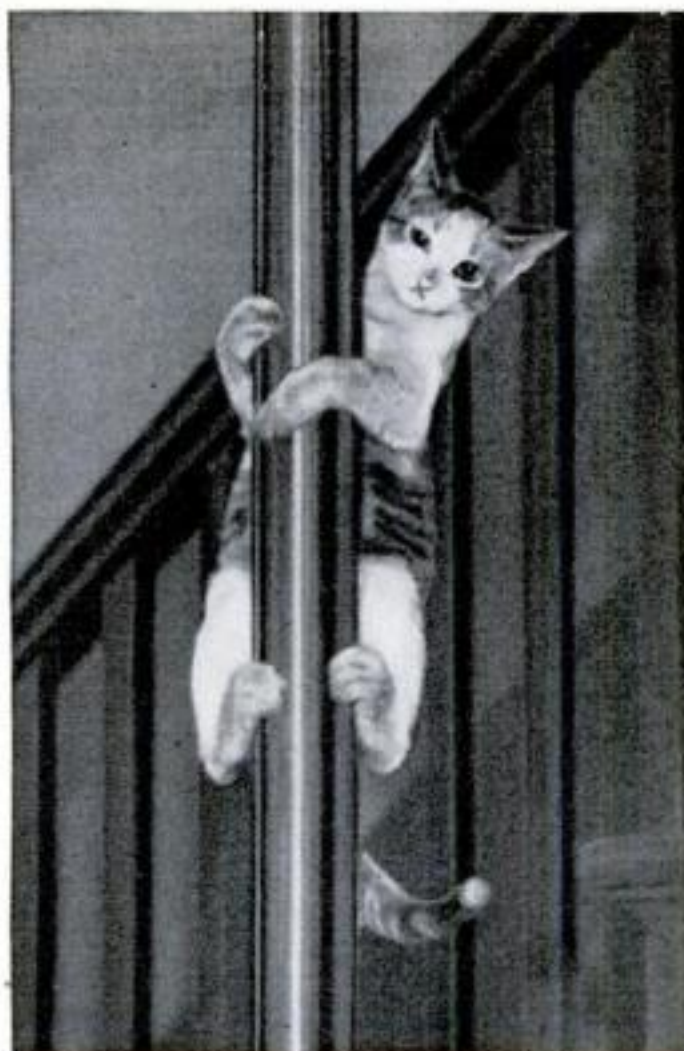
Fire-House Cat Answers Alarms

FIRST to respond when the alarm sounds in the fire house of Engine Company 13 in Chicago, Ill., is Minnie, the firemen's cat mascot. From wherever she happens to be, she makes a dash for the fire pole, wraps her paws tightly around it, and plummets down to the fire-engine garage, ready for action. That's the firemen's story, at any rate, and they point to the photograph at the right to prove it.



Wallet Pockets for Spare Keys

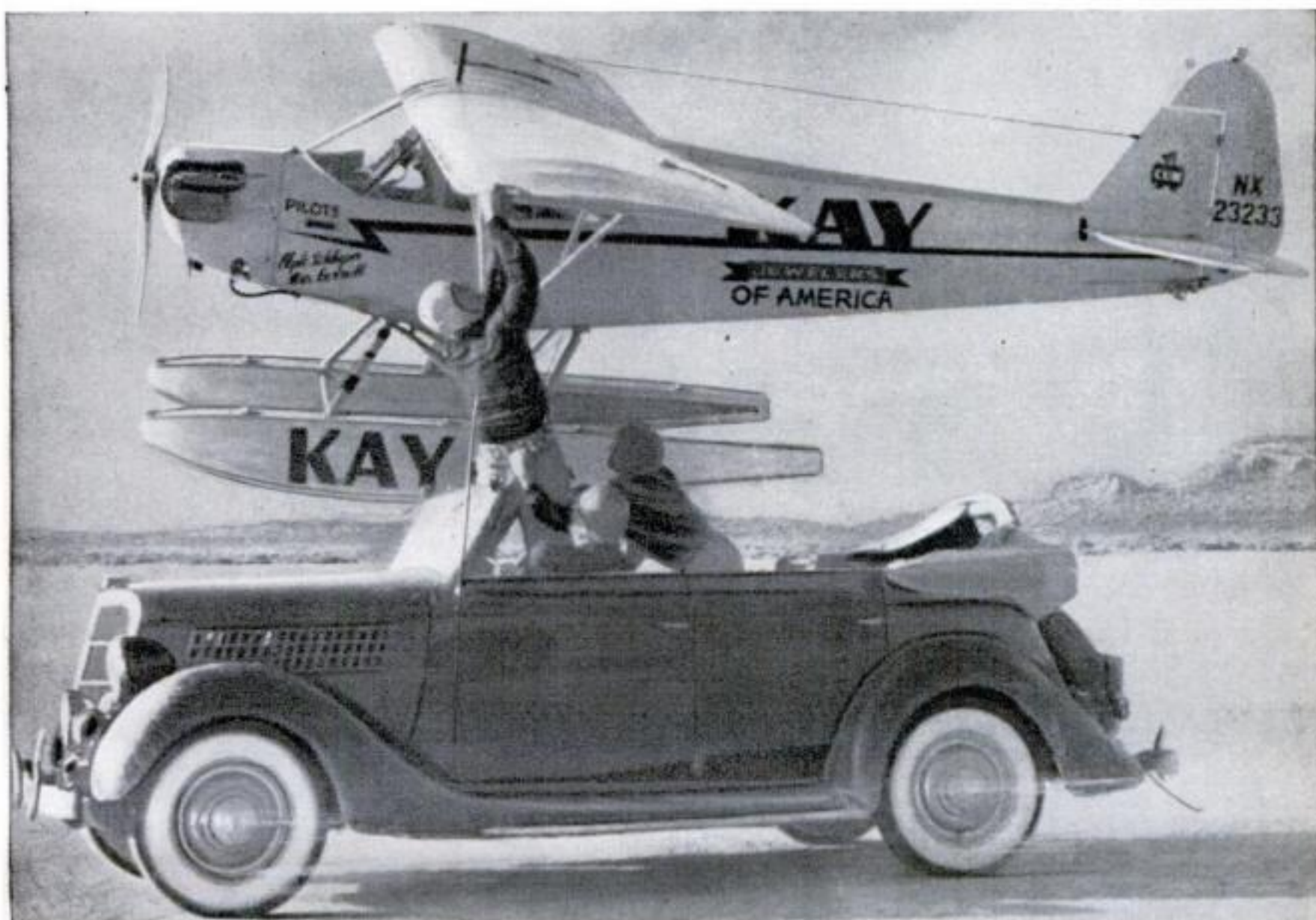
SPARE keys to the owner's car and to the door of his house may conveniently be kept in a novel leather billfold just placed on the market. Special key pockets are built into the wallet.



Mechanic in Car Repairs Flying Plane

ROARING across the bed of Rosamond Dry Lake, Calif., in a speeding car, Jack London, Jr., ground mechanic for the pilots of a seaplane which recently broke existing endur-

ance-flight records, replaced a blown-out wing light in the plane as it flew dangerously low beside the automobile. The dare-devil mechanic stood on the car's front seat.



Jack London, Jr., replacing a blown-out wing light on a seaplane in the course of an endurance flight

Dare

Camerman

By
JOHN E. LODGE

"**W**E WANT," said the boss engineer, "a picture record of all the tunnels on the Colorado River Aqueduct." Bill Fox squinted across the desk, high in a Los Angeles office building. "You mean," he replied, "I should take pictures of a hole ninety miles long?" The boss engineer nodded.

That was six years ago. Since then, Bill Fox has exposed 11,000 negatives in a variety of cameras. He has daily patrolled the aqueduct, a matter of 391 miles from Parker Dam on the Colorado River to the Pacific Ocean, covering thirty-five construction camps and twenty-nine tunnels. He has worn out four cars while traveling 250,000 miles. For good measure, as a one-man movie crew, he has taken 250,000 feet of sound pictures, thus providing a permanent record of the sounds attending the century's biggest construction job.

Bill Fox has faced the perils of underground flood, premature dynamite explosions, and chemical vapors which often fogged his lenses and produced

Bill Fox in action with his sound-movie camera



In this spectacular picture, workers are seen carrying a heavy board through an underground waterfall in the San Jacinto Tunnel

blank films destined for the developing-room wastebasket. He has licked the vapors and subterranean rainfalls, but, to this day, when he sees smoke and dust filling a tunnel, he folds his cameras and seeks the nearest exit. "You can't shoot through a solid wall," he explains.

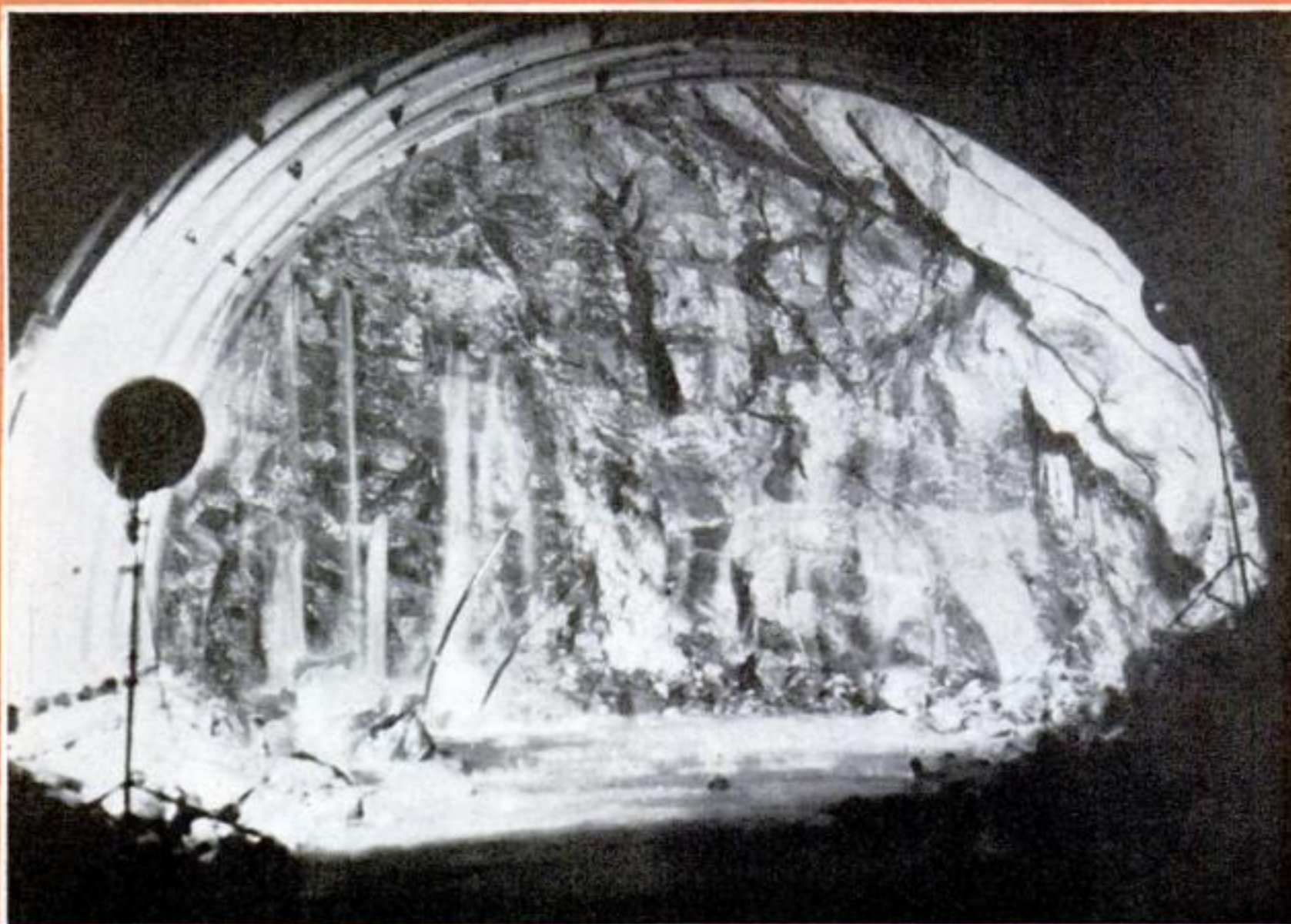
Fox drew this tough photographic assignment because of his love for the desert. For ten years he had lived at various times among the sand dunes of southern California, photographing the desert and its plants. When the Metropolitan Water District began looking for some one to make a picture record of the 1,000,000,000-gallons-a-day water-carrying project, they looked up Bill Fox.

His lenses have recorded the day-by-day progress of every unit in the big job. Of dams and reservoirs; tunnels, siphons, and conduits; shafts, passages, pumps, and pressure lines; a power system, highways, and a distribution system. When trouble threatens, one of the first calls goes to Bill Fox. He must take pictures before and after remedies are applied.

When he first unlimbered a camera to show a mucking machine tearing at crushed



Back lighting helped Fox to catch dramatic shots like this



Water pouring into the end of a tunnel. Fox's task was to record all phases of the huge job



A prophetic picture: water standing in a part of the vast aqueduct system to supply Los Angeles

rock, he knew nothing of underground photography. He saw gray clothing against black machines against gray rock. Back lighting largely solved the problem for long shots. Often he has found himself in crowded spaces when he wished for an Aladdin's lamp to help him overcome diffi-

culties that seemed to be insurmountable.

Valverde Tunnel was being pushed through crumbling granite. Without warning, the heading collapsed, crushing steel supports as though they were matches. One thousand feet of overbearing settled with a sigh, leaving a visible trench on the surface above. Passing the muck back in buckets, mud hogs drove a pilot hole, 400 feet long, on top of the crushed granite. Scarcely wider than a man's body—"looked like a rat hole to me," Fox declared—the drift led to a new formation. When the miners backed out, Fox crawled in. Near the end, fearing any minute he would be trapped, the photographer set off flash bulbs, took a picture of the formation, then backed out on his knees, a distance equal to almost two city blocks. Studying the picture, engineers planned new supports and soon Valverde was completed.

A few days later, the engineers handed him another crawling job. They wanted a picture showing work progress inside a metal pipe. Fox finished three earlier assignments, and on driving up to shoot the picture, he saw sparks flying a long dis-



The photographer was always on the spot when a tunnel was scheduled to be "holed through"



Fireworks from a cutting torch inside a metal pipe. To get this view, Fox crawled with his camera for more than half a mile through the pipe at the left



For moving shots, the cameraman built the camera dolly below. It is towed by an electric locomotive



tance away. Dropping to his knees, he eased his way 3,000 feet inside the pipe, before coming face to face with the cutting-torch expert.

Photographers on the surface, blessed with adequate equipment, know nothing of picture taking below the ground. Temperature in one tunnel may be lower than outside, and higher in another. Before dropping down a shaft or riding a muck train five miles, Fox places his cameras in the compressor room or the forge room for an hour. Thus they are "conditioned" to the air being pumped into the tunnel face.

Compressed air from ten drills, chattering as they drive steel into the rock, fills the tunnel with a vapor resembling the blue haze seen in the mountains. Fox cuts through this haze by using panchromatic film and light-yellow filters, on both still and movie cameras. He purposely seeks

thin negatives, and brings out contrast between the similar tones by developing negatives twenty-five minutes instead of the customary five or six.

He employs a historic camera to make sound movies. Rummaging around a Los Angeles shop several years ago, he found the first sound camera ever made for the newsreels, a silent machine rebuilt for sound. Fox made his own amplifier and battery cases, and set forth to take sound movies. Pro- *(Continued on page 228)*

Restaurant Has Rack for Newspapers

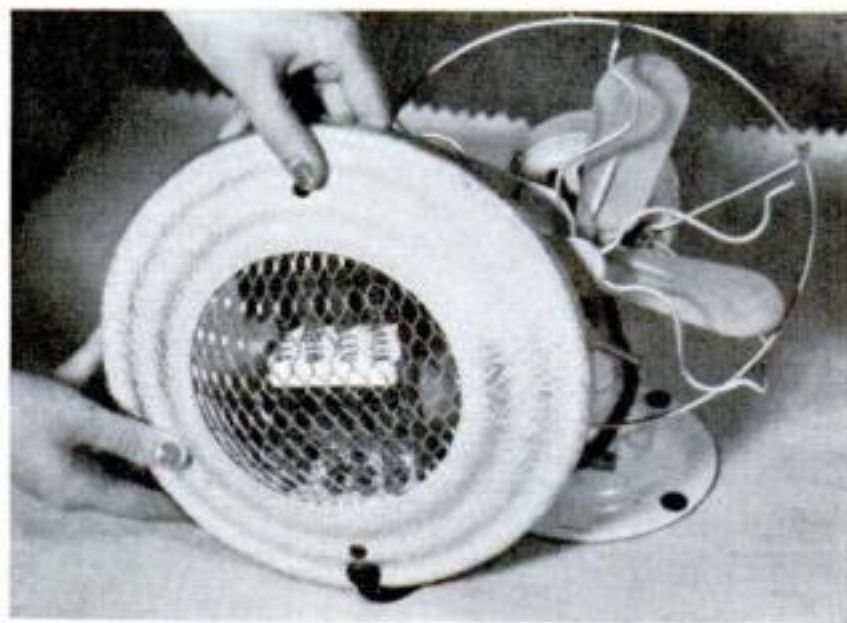


He who eats may read, at this restaurant counter in Cleveland, Ohio

READING a newspaper and eating a meal at the same time is usually a rather difficult job which ends up with a paper badly crumpled and a spot or two of food on your vest. To make the process easier, the owner of a Cleveland, Ohio, restaurant installed a special newspaper-reading rack above a wall counter. Over their morning coffee or a bite of lunch, patrons can now read the news easily from papers held securely on the rack before them, while both hands are free to concentrate on the business of eating. The popularity of the idea is evident in the picture at the left.

Attachment Turns Fan into Hot-Air Blower

AN ELECTRIC fan may be converted into a 1,000-watt circulating air heater through the use of a novel electric unit. Attached in front of the fan by means of four spiral springs, the disk-shape attachment has a central opening crossed by wire heating elements. Air blown through the disk is thus heated before it spreads around a room. The combination is plugged into a wall outlet and may be arranged so that both units are turned on or off at once.



Heating elements warm the air blown from the fan



Lettuce growing in a sandbag. The hose supplies chemical plant food

Food Is Grown in Sandbags

SANDBAGS can be made to produce food as well as to play their protective rôle in air-raid defense, according to an English horticulturist who has perfected a new liquid plant food. Vegetables planted in the sand grow out through the bag fabric, and are watered and fed with the chemical plant food, which is piped into the base of the sandbag through rubber hose.



Hotel-Roof Bomb Sentry Scans Skies for Raiders

HOTELS generally pride themselves on top-notch service in every detail that can make a guest comfortable. Even the possibility of an air raid does not interrupt that standard in a London hotel where a concrete observation room was recently erected on the roof for a sentry to scan the skies for the first sign of approaching enemy airplanes. Guests thus may be warned in time to make for the hotel's underground air-raid shelter.

Tooth-Powder Container Prevents Spilling

TO MAKE it easy to place tooth powder on a toothbrush without spilling is the purpose of a novel powder container recently invented. When the container is held in position over the bristles of the brush, a lever is pressed, and a measured amount of powder is ejected onto the brush. In addition to delivering a measured amount each time the lever is pressed, the device also presses the powder "charge" into a compact mass so that it will not spill.

New Blade Sharpener Uses Water Pressure

WATER pressure is used in a new type of sharpener for double-edge razor blades. The blade is placed between the unit's two plastic arms, which are then inclosed in a transparent cover. By means of a rubber faucet adapter, the sharpener is attached to a cold-water tap. When the faucet is turned on, water is forced at great pressure through pin-point holes along the razor's edges, which according to the manufacturer sharpens the blade in about two minutes.



The blade is sandwiched between two arms, placed in a case, and the unit attached to a faucet, as shown in the top photograph



Powder is placed on the brush without any spilling

Abandoned Mine



DEEP inside a Pennsylvania hill, in one of the strangest mines in the world, are two garden beds that may have a great influence on a popular eating habit. One is the world's first electrically heated mushroom bed, and the other is a normal "control area" for comparing results.

Electric cables buried about six inches below the surface of the first plot keep the soil warm and speed mushroom growth. While the electric bed cost \$111.50 and the control bed only \$7.55,

Paul B. Stoops in togs like a miner's examines some of his mine-grown mushrooms. At top, visitors inspect rows of the mine's mushroom beds

At the right, an assistant is shown picking mushrooms that actually contain sunshine vitamin, even though grown in total darkness. Later, they are dusted by an air jet, then packed in boxes for marketing



Yields Mushroom Gold

By WALTER E. BURTON

mushroom spawn planted in the electric bed will produce mushrooms in six days, as against sixty-four days in the control bed. The yield from the experimental heated bed over a given period was sixty-two and a half pounds, and from the control bed, twenty-four and a half pounds.

But whatever the results of the experiment, the place where it is being carried out is one of the most unusual farms to be found anywhere. Its proprietor, Paul B. Stoops, is a former high-school teacher who once raised mushrooms as a hobby. When physicians advised him to retire from teaching, his hobby evolved into a business. He leased an abandoned limestone mine near Ellwood City, Pa., and established his mushroom farm in it. Although that was little more than a year ago, about 102,000 square feet are already under cultivation, and production often exceeds a ton a day.

The mine, entered through a passageway in the side of a hill, covers 144 acres and includes a twenty-three-acre lake of water so clear that it is nearly invisible. The entries, totaling thirty-three miles in length, are thirty feet high and thirty feet wide. It is possible to drive a car for miles in the mine without ever seeing daylight.

Inside the mine, the temperature stands at fifty-two degrees F., the year around, and Stoops has found it a healthful place for himself and his twenty-one assistants to work. However, the climate is not so favor-



In this experimental electrically heated garden, mushroom growth is being studied and speeded up

able for automobiles. The damp, cool atmosphere favors rusting, and when a car is driven out into warmer air, moisture condenses on every part of it. A year in the mine is all that any car can stand.

One of Stoop's most interesting achievements is to put sunshine vitamin in a plant that grows in total darkness! Vitamin D comes from soil which reaches the mushroom mine in the form of manure. Stoops purchases it in 100-ton lots and has it piled in long rows. The manure is converted into an odorless humus, a process requiring six weeks during which the rows must be turned over every seven to ten days. The humus is then used to make the beds in which mushrooms are grown. Vitamin D in the mushrooms comes from the grain contained in the manure.

Stoops is not content merely to raise and sell mushrooms. He is constantly experimenting to produce better crops and to develop new edible varieties. One of his ambitions is to develop a stemless mushroom. His mushroom mine that used to be a limestone mine is now a gold mine. Repeated efforts have been made to induce him to sell out. But he intends to continue his experiments and extend his subterranean acreage.





Closely resembling polished walnut, the gunstock and fore-end above are actually made of plastic material

Plastic Replaces Wood in Stocks of Guns

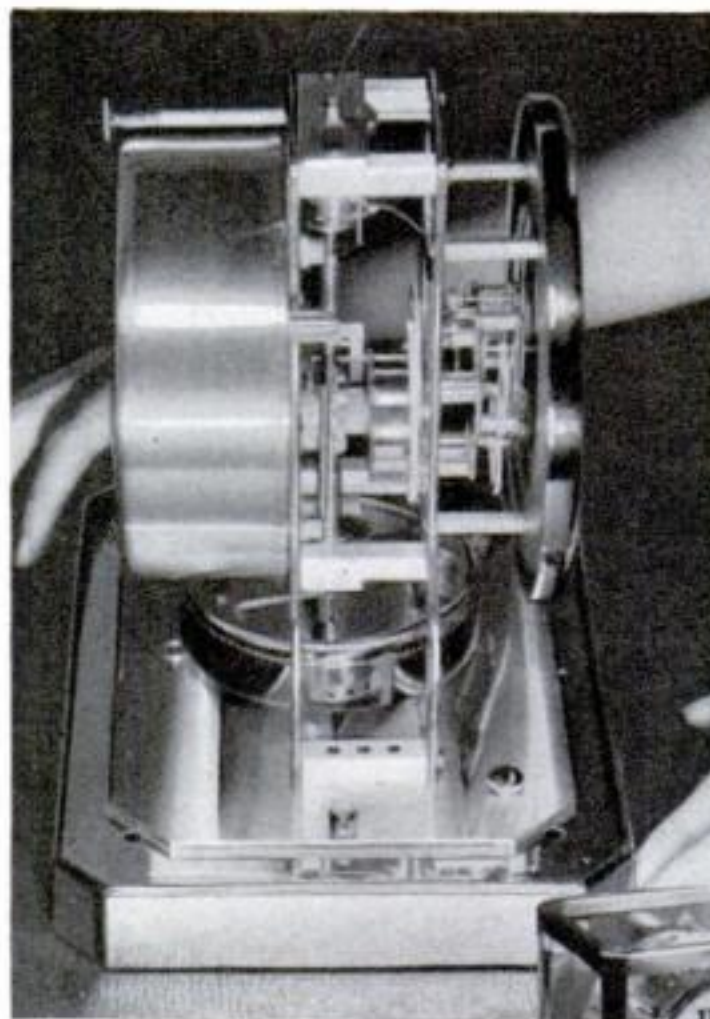
STOCKS and fore-ends made of synthetic plastic instead of wood are now being provided for shotguns, and are being considered for the mass manufacture of military weapons. Said to be more durable than wood, as well as capable of being produced easily in large quantities, the material has lower moisture absorption and greater resistance to shock and vibration than wood, while presenting the same smooth-grained surface effect of fine walnut.

New Chemical Treatment Removes Peanut Skins

CHEMICAL baths that remove the reddish skins from shelled peanut kernels have been devised by research chemists who claim a new high in freshness and flavor for the lowly but popular food when thus treated. Heretofore, methods of removing the skins have had the effect of drying the kernels, splitting, shrinking, or deflavoring them.

Atmosphere Clock Needs No Winding

REQUIRING no winding once it is started, a perpetual clock recently introduced runs without further attention except for possible periodic adjustments for accuracy. Its carefully designed and delicately constructed mechanism is driven by a spring that is wound by the changes in atmospheric pressure that constantly take place. Similar in principle to the familiar aneroid barometer that records atmospheric changes on a dial for predicting weather changes, the motor consists of a hermetically sealed drum, one side of which is a flexible metallic diaphragm. From the diaphragm a fine chain runs to the mainspring that stores up the energy of the diaphragm's movements as atmospheric changes occur, and releases the energy into the clock gears. A drum-type oscillating balance wheel governs the speed of the clock.



Atmospheric changes compress and expand a sealed drum on the back of the clock works, shown at left. The motion is used to supply power to the clock





Sterilizing milking equipment with the new pail, which has a built-in electric heater. The plug pops out if the liquid boils down

Built-In Electric Heater Warms Liquid in Pail

A GALVANIZED pail equipped with a built-in electric water-heating element is now on the market. Furnished with a ten-foot rubber-insulated connecting cord, the fourteen-quart pail features an automatic safety device that ejects the plug from its socket at the base if the liquid contents should boil down to a dangerously low level. The pail has many uses in industry, on the farm, and in the home, including sterilizing, warming water for poultry, cleaning dairy equipment, heating bath water, cooking boiled foods, and warming water for dish washing.

Flash Light Protects Hikers

PROTECTION for pedestrians walking at night along unlighted roads is afforded by an inexpensive new flash light designed to be hung onto the walker's belt. Fitted with a wooden battery case, the light has a translucent plastic tip that surrounds the bulb and gives off a red glow to warn motorists.



Women Meet in Paper-Hanging Contest

GRANTS PASS, ORE., was the scene of one of the oddest contests ever held, when women recently gathered from the surrounding country to compete in an outdoor paper-hanging contest. Striving for substantial prizes, the female paper hangers were required to cover with wall paper a slab eight feet high and five feet wide within a time limit of three minutes. Prizes were awarded on the basis of the smoothness and evenness of each job to those who had finished the work within the allotted period. A group of contestants is pictured at work.



Women show their skill as paper hangers in a contest at Grants Pass, Ore.



Movie Hurricane Maker Saves Oil Well

WHEN a well in a western oil field got out of control recently and spouted thousands of cubic feet of highly inflammable gas into the air, oil operators called on the movies for help. They borrowed a wind machine of the

type that creates storm scenes for films, trained it on the well so that it blew the gas away from hot boilers near-by, and then capped the well after a two-day battle, thus preventing a dangerous explosion.



Testing a bone-conduction hearing aid on a dog

Hearing Aid for Humans Works for Dogs, Too

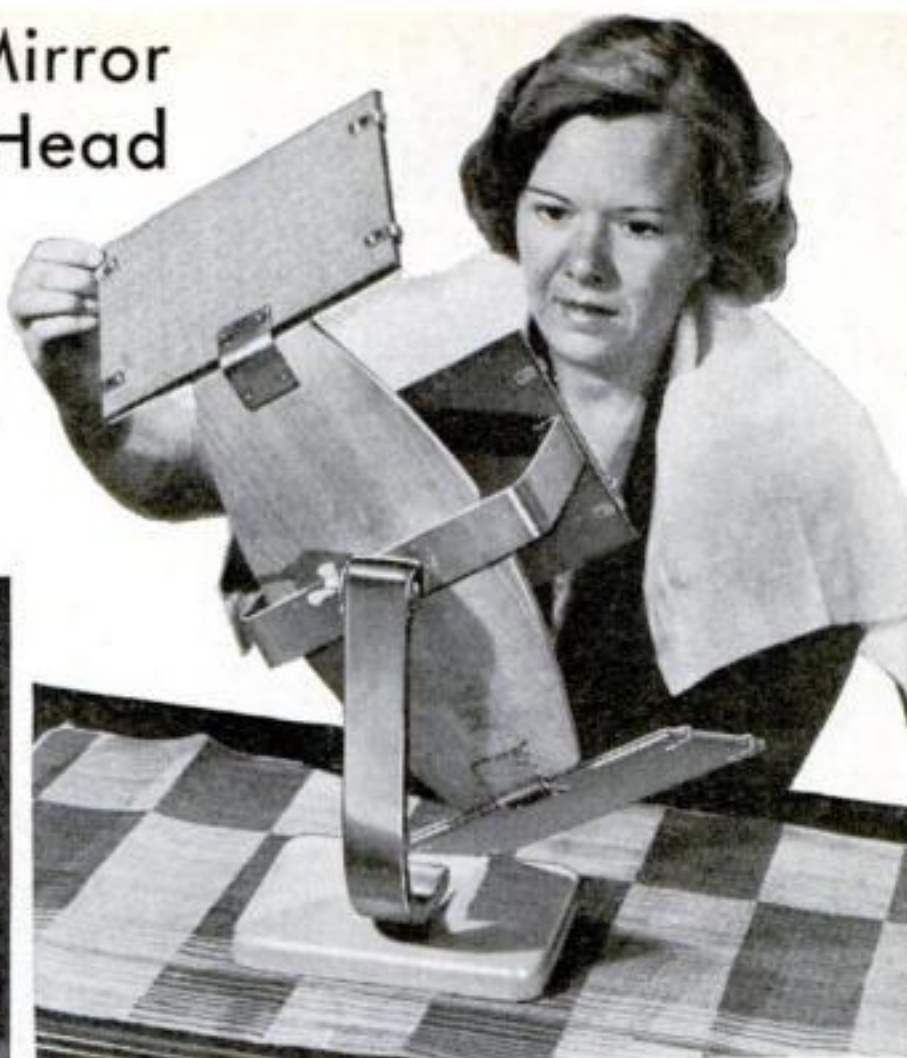
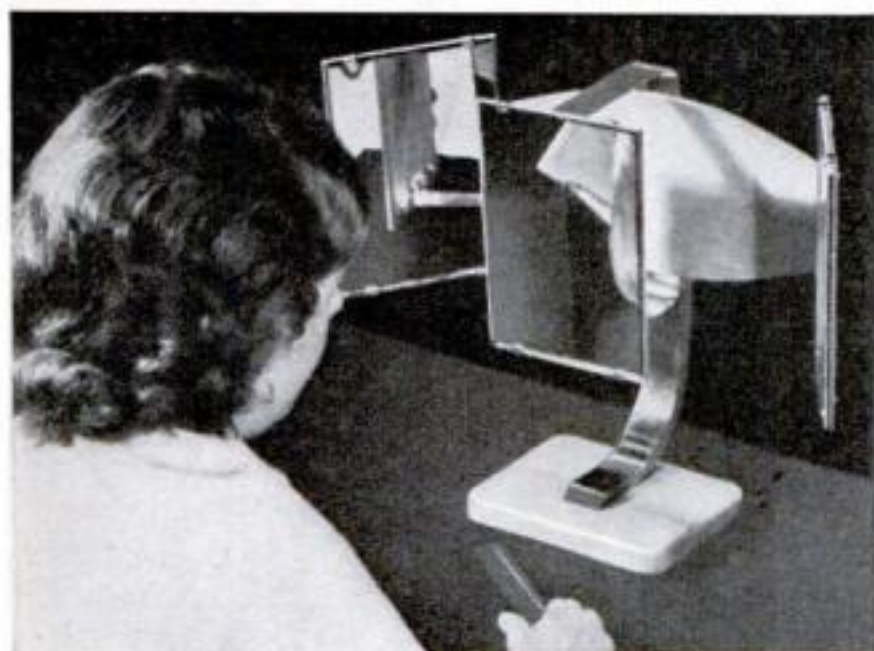
WILL hearing aids for humans correct partial deafness in animals? To find out, a Kansas kennel owner recently brought a partially deaf Dalmatian to Kansas City, Mo., for a series of tests by experts in hearing-aid devices. Experiments soon showed that instruments of the bone-conduction type aided the dog's hearing, and a special unit is being developed to fit the dog.

"Wool" Made from Corn

WOOLLY fibers, with many of the properties of the wool of animals, can be produced from ordinary American corn, research chemists have announced. The fibers are derived from "zein," a by-product of corn processing, which also can be made into plastics and waterproof wrappers.

Novel Dressing-Table Mirror Shows Any Part of the Head

A TRIPLE dressing-table mirror just introduced allows the user to see any part of the head or face with ease. The adjustable side mirrors, placed to the rear of the center mirror, act like the mirrors in a periscope to give a view of either the top of the head or the underpart of the chin.



Pivoted so that it can be turned, and with two of its mirrors arranged like a periscope, this triple mirror is ideal for make-up purposes

Do Our Muscles Work When We Think?

IT IS impossible to imagine yourself doing something and, at the same time, remain completely relaxed, with no muscular reactions. That is the contention of William A. Shaw, Columbia University professor of

psychology, who recently conducted a series of interesting electrical tests in a study of the relation between muscular activity and mental imagery. Electrodes strapped to the forearms of subjects were wired to amplifying equipment and then to a cathode-ray tube, where small electric currents created by muscle movements were transformed into visual lines on the tube's screen and photographed. Subjects first relaxed in a cushioned chair, then picked up a weight from a table, put it down, and finally tried to imagine, without success while remaining relaxed, that they were picking it up once more.



Tiny currents set up by muscular actions are registered on the cathode-ray tube above. Tests indicated that the man could not imagine the act of lifting his arm when he was completely relaxed



How Many Fish in



WHAT is happening to the fish in the sea? Do we face a shortage of food from this important source? Some startling news recently has been reported by ocean-going scientists who have tagged thousands of fish caught above the narrow continental shelf off the west coast of the United States. The tiny metal tags, returned by fishermen and trapped by electricity in the canneries, reveal that the mackerel is vanishing.

Survey ship "Bluefin," one of the vessels in which scientists check movements of fish. Below, commercial fishermen yanking in tuna off the Mexico coast



Elsewhere on the Pacific and Atlantic, and in the Gulf of Mexico, state and Federal scientific sleuths count clams, perform surgery on sardines, tag mackerel, Alaska herring, tuna, weakfish, whitefish, shad, flounder, striped bass, and shrimp. From them they are learning the secrets of the wandering inhabitants of the deep, to protect these food supplies for the future.

Every year, U. S. Bureau of Fisheries experts tag thousands of herring in Alaskan waters, then stand guard alongside electric recovery machines in the canneries. Conveyors passing 100 fish a second are surrounded by coils within which an electrical field is maintained. When a fish carrying a tag, which weighs only one fiftieth of an ounce, moves into the field, the resulting disturbance closes a trapdoor, automatically boxing off part of the chute. While the flow of fish halts momentarily, herring held in the box are fed through the coil slowly until the tagged individual is isolated.

The tags have revealed that herring intermingle very little, and overfishing in a given area depletes it quickly.

the Sea?

WORLD FISHERIES

Down the Pacific coast near San Pedro, the California Fish and Game authorities are conducting a mackerel census. Three years ago fishermen caught 145,000,000 pounds of this species, largely within the 300-mile line between Monterey and San Pedro. Last year, only 55,000,000 pounds were taken. Meanwhile, from the laboratory vessel *Bluefin* 40,000 mackerel have been caught, tagged, and returned to the ocean.

Poring over charts showing where the

tagged fish were caught, scientists recently learned that not only were these mackerel migrating between San Pedro and Monterey, but that the various schools come from the same stock. Thus, unlike the story of the herring in Alaskan waters, depletion in one area means depletion in all. To meet this challenge, state and private agencies now are pooling their efforts to save California's mackerel fishery for her fleet of 400 boats. In these and in adjacent waters, sardines, valuable both as food and bait, have been known for

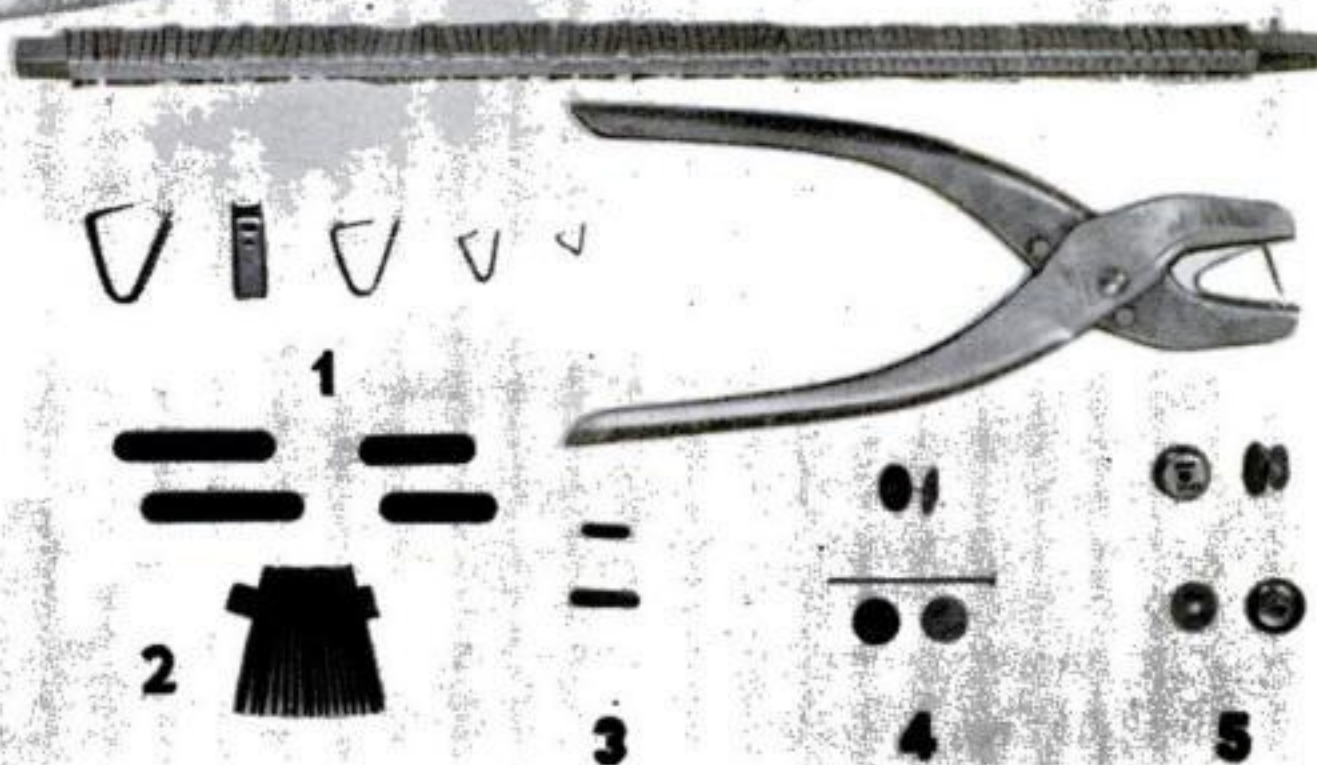
By ARTHUR A. STUART



Some fish are marked with strap tags like the one shown above

Marking fish by surgery: At top, an incision is being made in a sardine to receive a tag. The cut-away view above shows the location of the tag in the body of a marked fish

License plates for the fish come in several styles. (1) Strap tags with tool for clamping them on tail fins (2-3) Internal tags of various sizes (4) Celluloid disks (5) Metal buttons





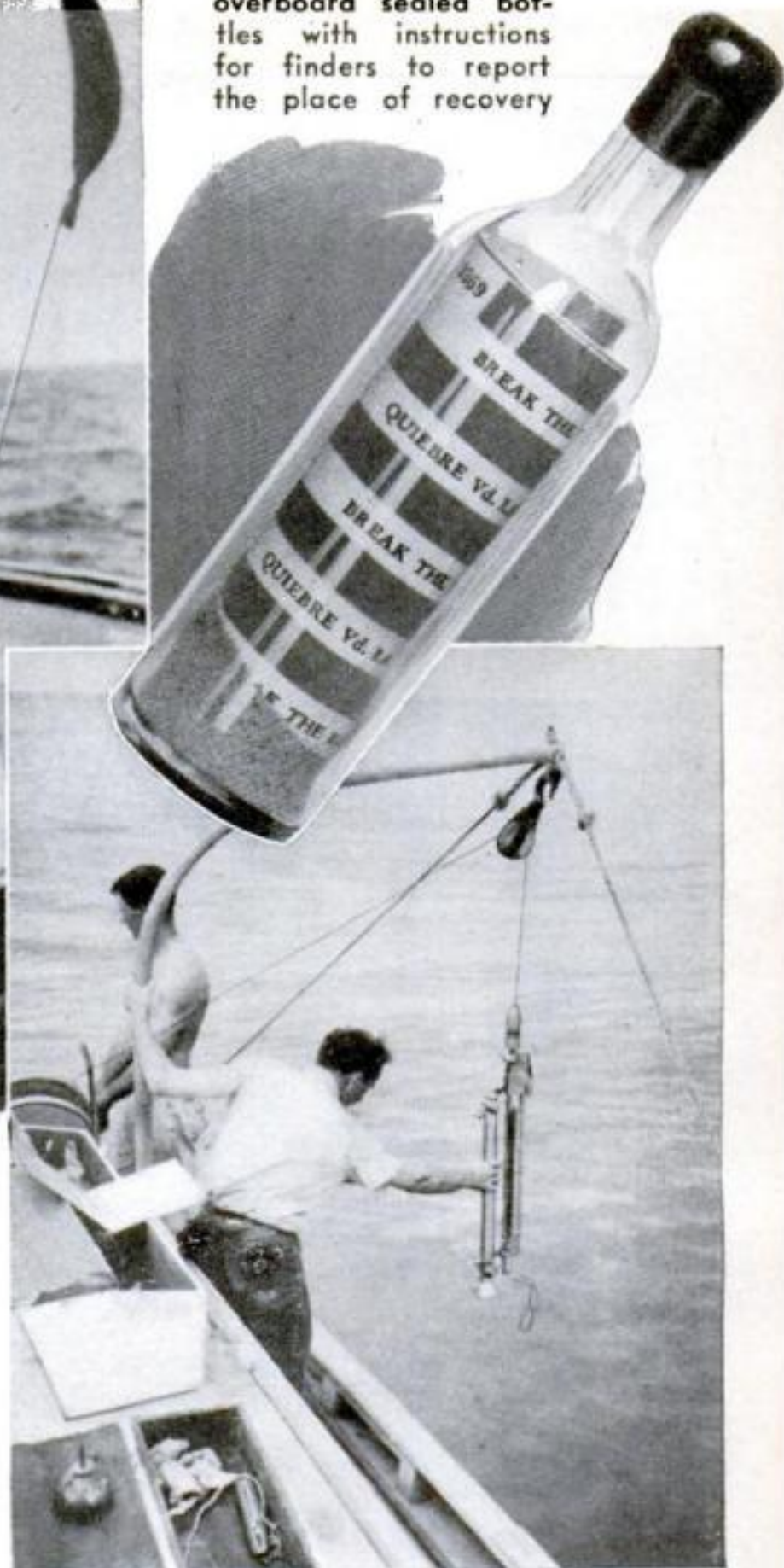
Fishing for science, a research worker hauls in a tuna on a trolling line aboard the "Bluefin." Right, investigators taking a sample of water from the bottom of the Gulf of Mexico

several years to be on the wane. The major spawning grounds for the whole Pacific coast lie outside the Channel islands, between San Diego and Point Conception, in some cases 170 miles from shore. How, then, do the baby sardines, scarcely as large as your finger, manage to reach inshore waters?

Again from the *Bluefin*, the answer was sought. Starting from Santa Barbara, the little ship ploughed 170 miles due west, returning along a parallel line thirty miles south. At intervals, bottles weighted with sand and containing cards bearing instructions in Spanish and English for their return, were dropped overboard. Numbers on the cards indicated where they were lowered into the sea. When the many reports are charted, western fishermen will receive new light on the effect of ocean currents on the distribution of sardines.

At the same time, fish surgeons of Canada's Biological Board, the British Columbia Provincial Fisheries Department, Oregon's Fish Commission, and the California Fisheries Laboratory have undertaken thou-

To check the drift of sardine eggs and larvae, scientists throw overboard sealed bottles with instructions for finders to report the place of recovery



sands of operations on sardines. The fish are caught in nets, after which operating teams, wearing white canvas gloves to facilitate handling their slippery patients, set feverishly to work. While one expert makes an incision for the tag with a sharp scalpel held in the right hand, another presses the upper and lower lobes of the tail fin together with his left hand and notes the sardine's total length on a measuring board. Then tagger No. 2 picks up a flat nickel-plated tag, inserts it in the incision, and pushes it within the body cavity. The tagged sardine immediately is dropped overboard.

Of the 54,000 sardines "planted" as specific locations off the California coast, 1,300 have been recovered by the electric detectors

in reduction plants. Some have wandered in a few weeks from Santa Monica 1,300 miles to British Columbia.

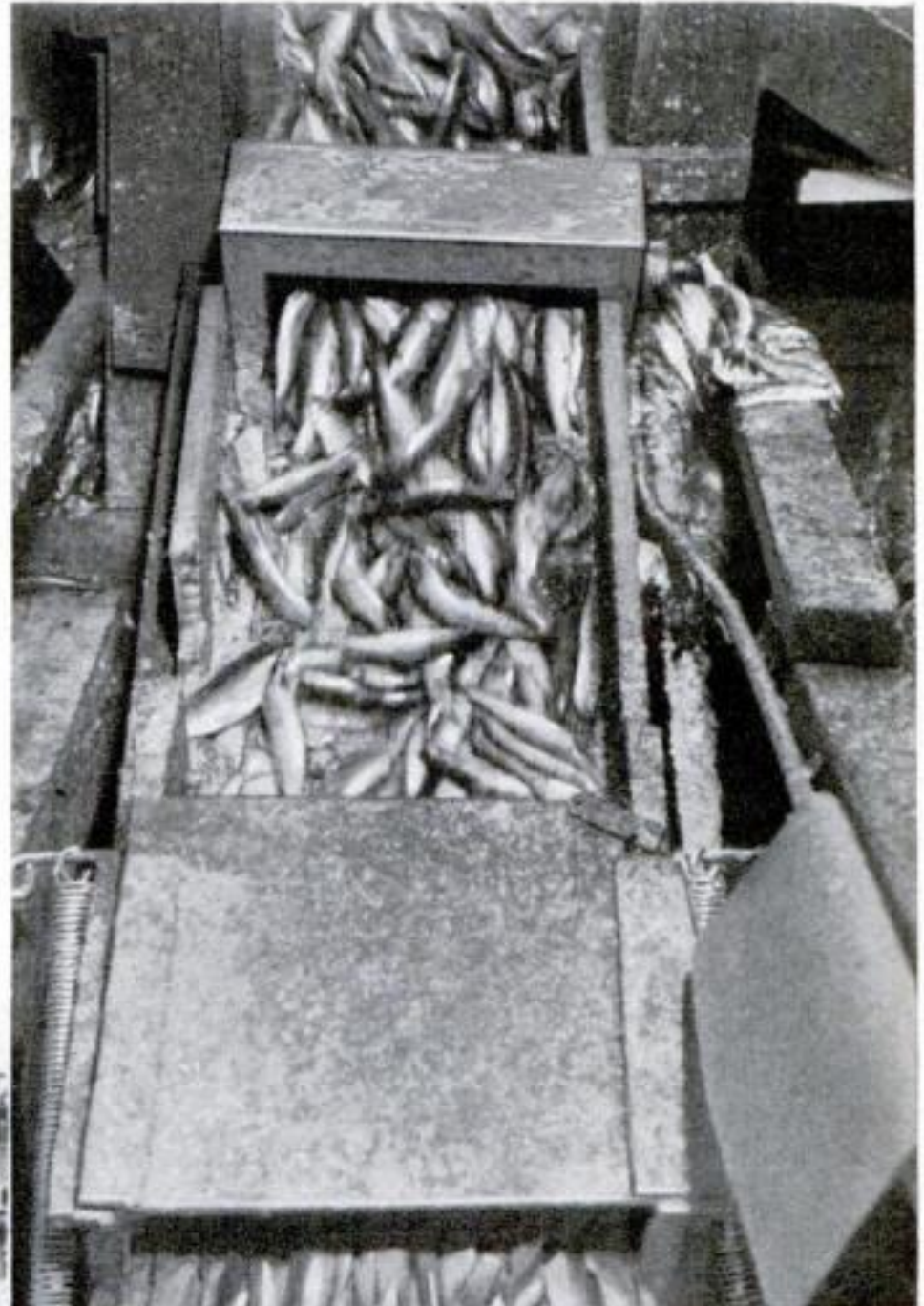
Off the coasts of Texas and Louisiana and between Cape Hatteras and Brunswick, Ga., new and more powerful shrimp trawlers have extended their operations hundreds of miles. Where do shrimp spend their winters, when and where do they move from place to place? Once more, thousands of tags may trick the shrimp into revealing these secrets. One lone shrimp traveled 300 miles in three months along the south Atlantic coast.

Operating from commercial fishing boats, California taggers have applied metal identifications to 4,000 yellow-fin tuna and skipjack, and not one was out of the water longer than twenty seconds. These come aboard on barbless hooks, tags are applied on the right side, and back into the briny goes the fish.

"Tagging on a commercial boat," relates H. C. Godsil, one of the veterans at the game, "brings more thrills than a sports angler may expect in many years. Working amidst a seething mass of struggling fish, we are literally drenched in a flying spray of water, blood, and slime. Frequently, too, the weather rail rolls beneath a wave, and

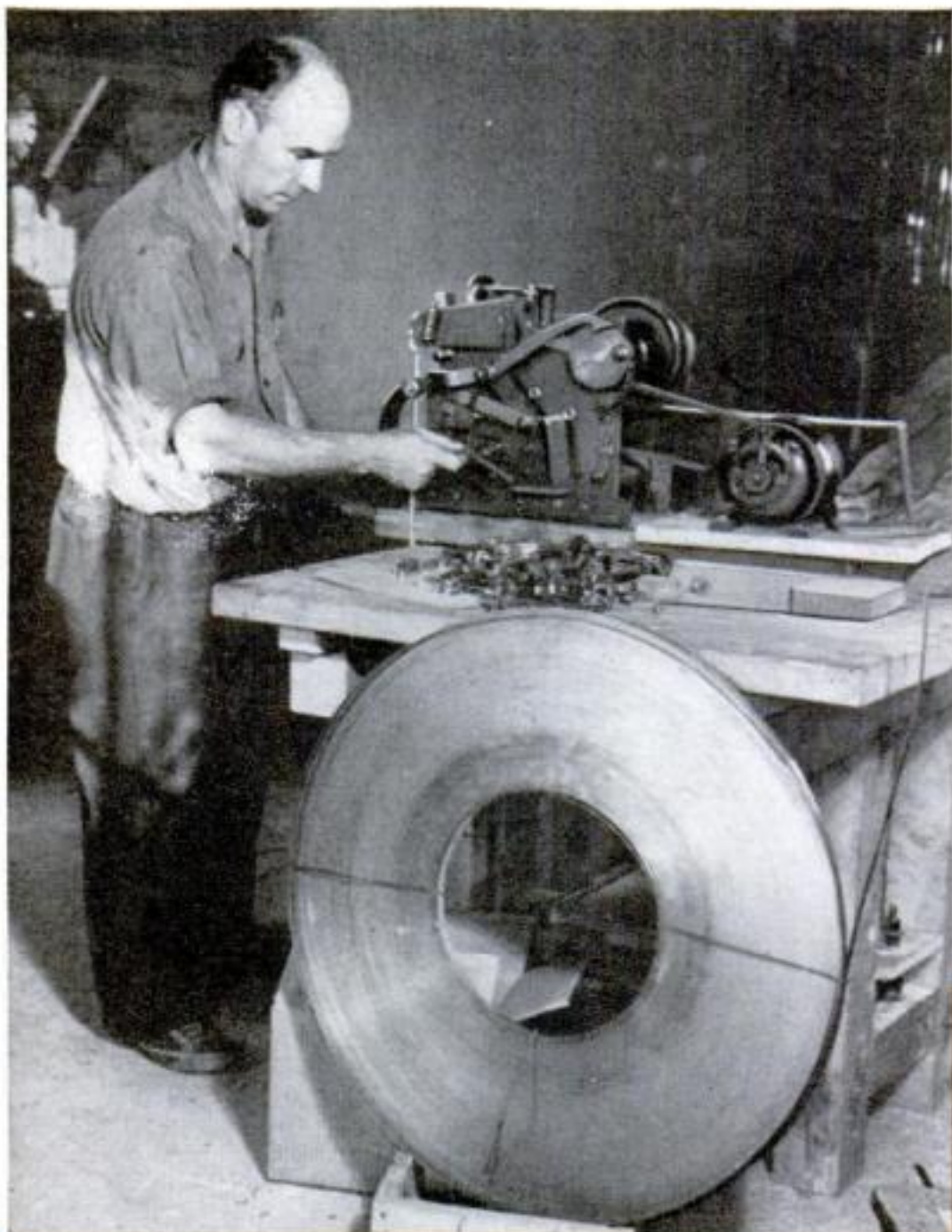
on the return roll to leeward everything ends up in the scuppers, with the fish actually swimming on the deck!

Not yet has a tagged tuna been recovered. Godsil believes that when another 6,000 are tagged, however, there will be results, and still another sea mystery will be solved.



The sardine fleet at San Pedro, Calif. This great industry may be saved by the studies made by fisheries scientists. Inset shows fish on a cannery conveyor passing a detector that spots tags.

One-Man Factory

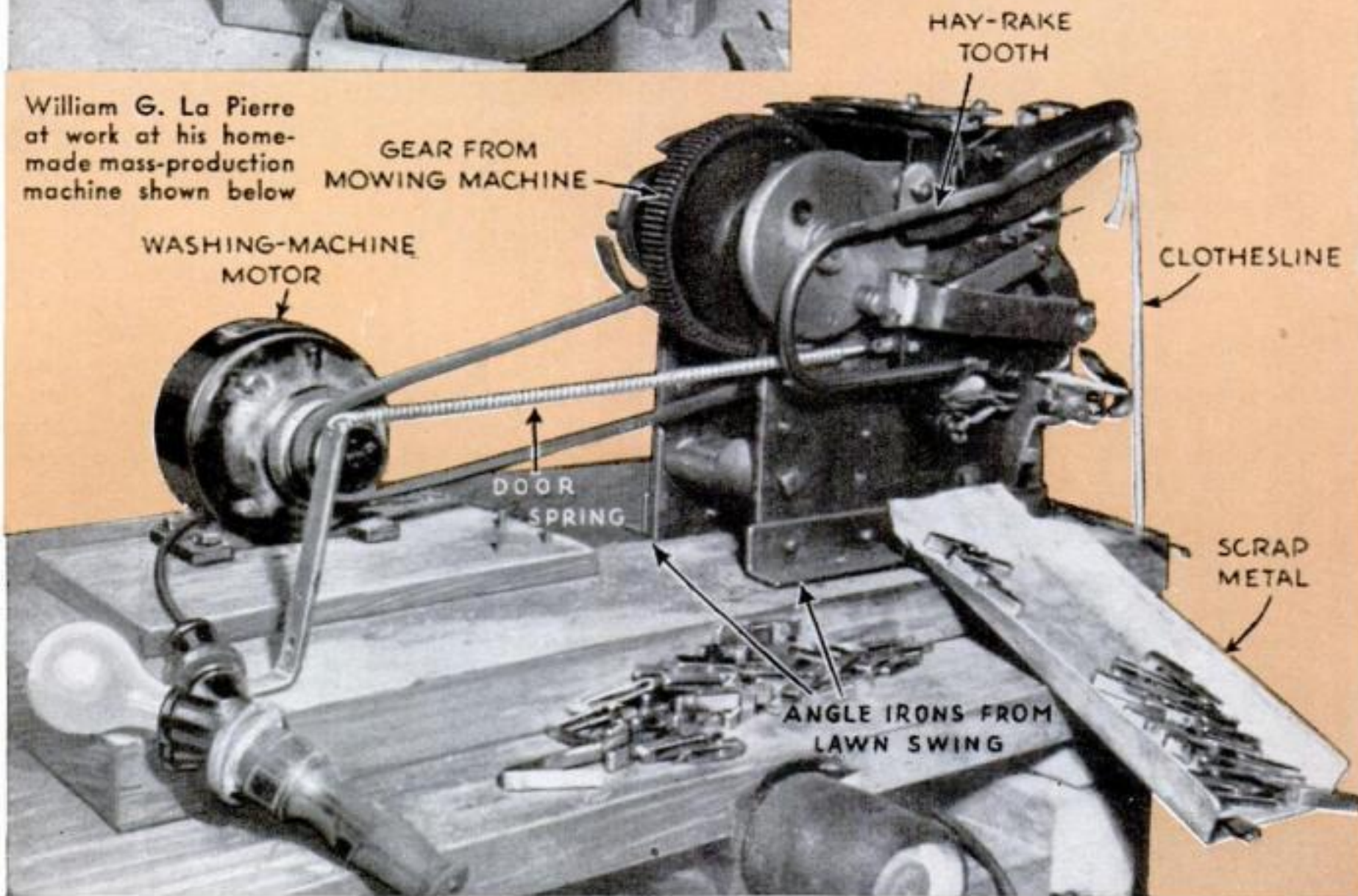


YOU follow a country road that winds into the hills east of Greenville, N. H. A mile and a half from town, you pull up before a gray, one-story structure, nestling on the edge of a hillside orchard. Once the building was a blacksmith shop. Now it houses William G. La Pierre's one-man, mass-production factory—probably the most unusual manufacturing plant in the country.

It is a factory that Yankee ingenuity has produced from odds and ends at a cost of almost nothing. The stove that heats the interior in winter was created from a steel barrel. The tape moistener, employed in sealing packages, was produced from wooden rollers turned out of maple stovewood, a rawhide boot lace, pieces of cloth cut

By **JOHN BENNETT**

William G. La Pierre at work at his home-made mass-production machine shown below



from a child's coat, part of a knife used for cutting honeycomb, and braces from an ancient buggy top!

La Pierre, genial and hard-working, has spent most of his life around the machines of New England textile mills—inventing on the side. A few years ago, when one of his duties was to lock up a mill at night, he lost a bunch of keys. As a result, he invented and patented a simple clasp which snaps on a belt and holds a key ring so that such losses are impossible. Several of his friends at the mill asked for similar clasps, and in a short time La Pierre was having a steady sale for his hand-made product.

Early last spring, he decided to market his clasps in quantity and started his unique one-man factory. All the thousands of clasps which have been sold in eastern states have come from the single room of this hillside plant. La Pierre is president, treasurer, sales manager, factory superintendent, shipping clerk, and delivery man, rolled into one.

The center of interest in his factory is the mass-production machine, capable of turning out more than 6,000 of the patented key-ring clasps in a single working day. It is a masterpiece of odds-and-ends creation.

The quarter-horsepower electric motor which furnishes the power once saw service on a washing machine. The plank which forms the base on which the 100-pound mechanism rests was originally part of the



In this one-room plant, La Pierre can turn out 6,000 key-ring clasps in a day. Left, his steel-barrel stove

floor of a farmyard tool shed. And the pedals, on which La Pierre steps to operate the machine, were obtained from a rack on which the drummer of a local band once arranged his percussion instruments.

The internal anatomy of the machine represents an even stranger assortment of mechanical remnants. A tooth from a hay rake forms the tripping mechanism and another tooth

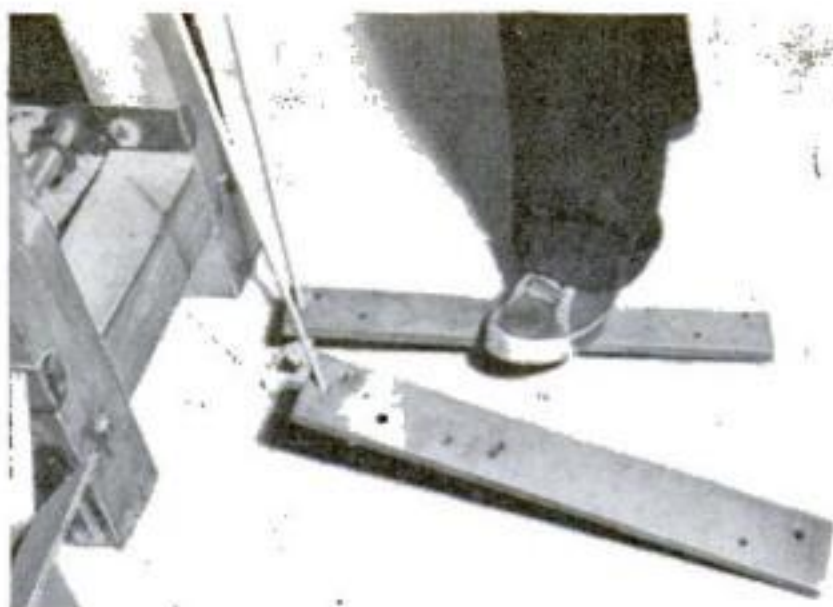
from a similar source, forged into a flat spring, reverses the action of the machine at the end of each operation. The camshaft came from an abandoned mowing machine. The angle irons which secure the mechanism to its plank base were salvaged from the wreck of a lawn swing, while a junked car contributed the bolts which hold the

● HOW YANKEE INGENUITY TURNED ODDS AND ENDS INTO HIGH-SPEED MACHINERY FOR MASS PRODUCTION

various parts of the odd machine together.

The queerest source of all, however, supplied several gears. Some years before, another inventive New Englander had operated a chicken farm near-by. One winter, he came to the conclusion that crawling out of bed about daylight to feed his flock of 100 hens was entirely unnecessary for a man of brains. So he contrived an ingenious mechanism to take his place. Each morning at feeding time, when the hands of the clock reached a certain point, the gears and levers of this robot went into action, tipping over a small trough and scattering grain over a feeding platform. Every one, including the hens, seemed satisfied with the arrangement and the clockwork feeder continued in use until the poultryman sold his farm and moved away. The new owner, having no use for the contraption he found in his hen-house, passed it on to La Pierre. And so the cogs from this strange device found their way into his factory machine.

When La Pierre sets the washing-machine motor humming and the odds-and-ends mechanism clanging away, he can finish up



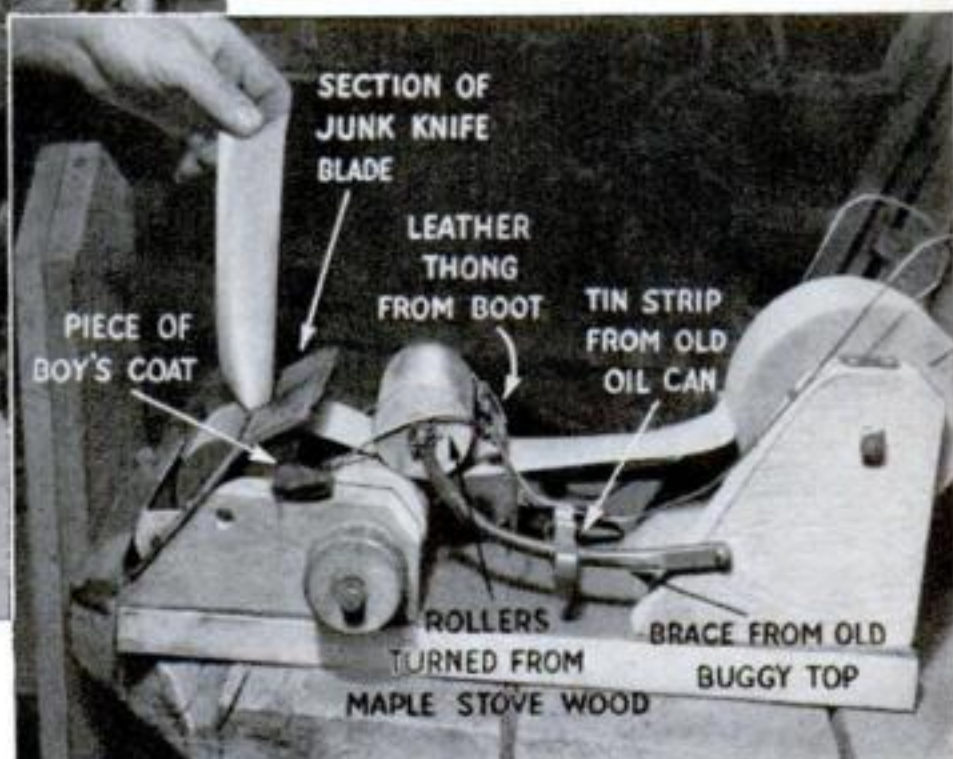
These foot pedals, with which the inventor operates his machine, once formed part of a rack on which a trap drummer arranged his instruments

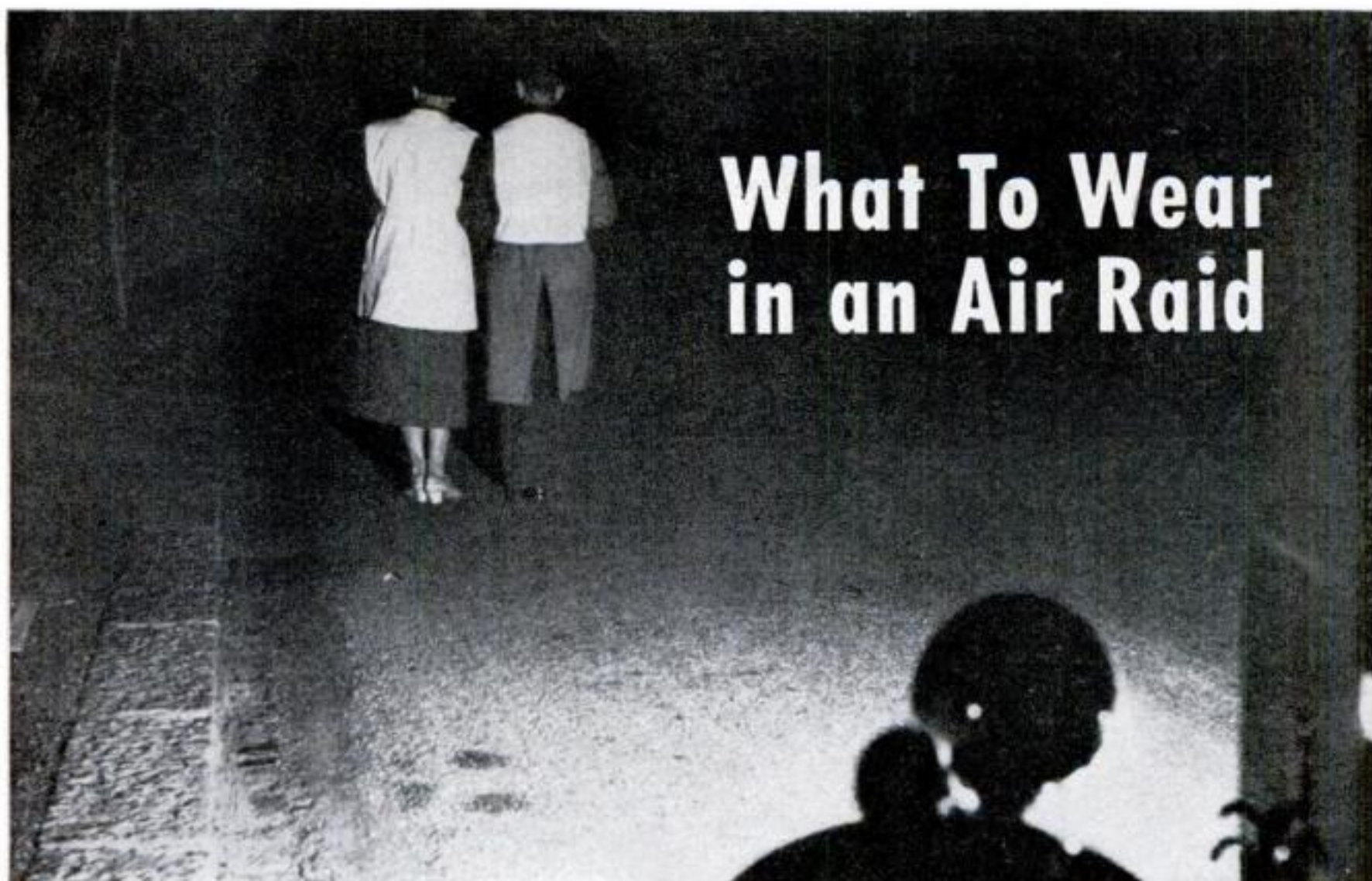
600 or 700 clasps an hour. Slipping a short strip of carbon steel into one side of his machine, he steps on a pedal attached to a trip lever by means of a length of clothesline. There is a quick shuffling of the parts of the machine and out comes the strip, bent at both ends. Sliding it into the other side of the mechanism, he steps on another pedal and completes the operation. The finished clasp is kicked out onto a chute made of galvanized iron left over from a rain spout. From here, it slides down into a waiting box. When the carton is full, it is carried to the packing bench.

Since his first clasp was designed, La Pierre has produced a dozen variations, making the models by hand from strips of brass. He has planned a new production machine with interchangeable parts, so any of the twelve styles can be turned out as demand dictates. And, already, he is busy piling up metallic odds and ends to use in the construction of this larger and more elaborate machine.



In the "packing department," cartons of key-rings are sealed with the aid of an ingenious tape moistener, seen in detail at right





Pedestrians in the British capital wearing white coats that make them visible under dim headlamps

SHROUDED in an inky pall, the streets of London during a nighttime air-raid alarm when all lights are extinguished present serious traffic hazards that British pedestrians are now meeting in a number of ingenious ways. White coats worn over regular clothing reflect the dimmed headlights of cars, trucks, and busses. White paint marks sidewalk curbs, the shoulders of highways, and even the treads of stairway steps. The former Ambassador to Germany has adopted a cane striped with white and black paint. And one Englishman clips a flash light to the back of his hat.

At the far right, Sir Neville Henderson, former British Ambassador to Germany, carrying his air-raid stick. Notice the painted stair treads

Another strange product of the war is the hat tail light. A flash light fitted with a blue-shaded lens is attached to the hat to protect its canny wearer against being hit by a car in the darkness





Bounty Crop on One Stem

TWENTY-THREE ears of corn on one stem is the agricultural freak that appeared in the cornfield of William B. Hewitt, of Cooper's Mills, Me. The ears were knotted together in a tangled mass, as pictured above.

Fire-Extinguishing Gun Is Worked by One Hand

SAID to be the only carbon dioxide type of fire extinguisher that can be operated with one hand, the unit pictured below is aimed at a fire like a gun. When the forefinger pulls on the trigger, the nozzle discharges a thick, heavy blanket of carbon dioxide gas that smothers the flames quickly. The nozzle of the two-pound extinguisher can be swung and locked into various positions, to furnish the most effective angle of discharge.



A handy pistol grip permits aiming the extinguisher

Robot "Rat" Tests Foods for Vitamins

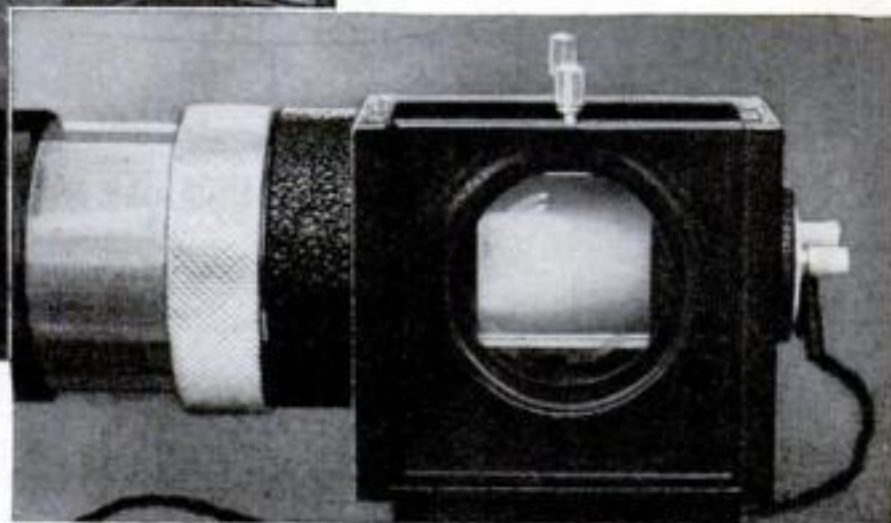
AN ELECTRICAL "rat" that aids in testing the vitamin content of various foods and drugs has recently been developed by Dr. Douglas J. Hennesy, of Fordham University,

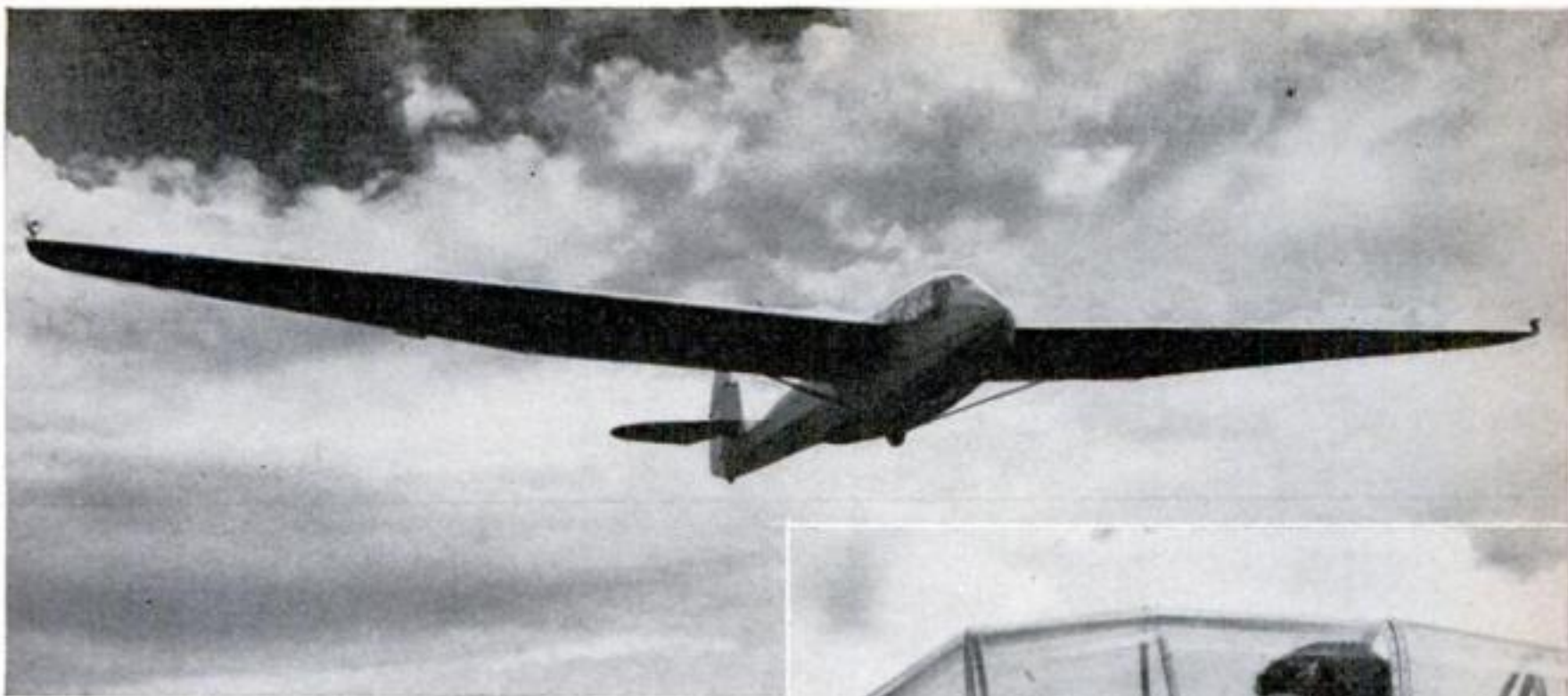
in New York City. Before the development of this apparatus, the potency of vitamins was generally measured by performing slow biochemical tests on live rats, in which the

substances being examined were injected into the bodies of rodents, and then checked by determining the physical reactions of the rats. With the new device, the fluorescent illumination from a vitamin is registered directly by means of a photo-electric cell and a meter, quickly showing vitamin potency.



Minute quantities of vitamins being examined in the apparatus that replaces rats for observation tests. At the right is the "brain" of the mechanical rat





Radio Car Aids Glider Pilots

TWO-WAY radio, establishing contact between the pilot of a soaring sailplane and the driver of a cruising automobile on the ground, facilitates the gliding activities of a New York glider club. Installed in the club's all-metal sailplane is a two-way radio set that operates on a frequency of five meters and weighs but twelve pounds, including the batteries that supply it with



Soaring aloft, the sailplane pilot establishes two-way-radio contact with the driver of the car below

power. An automobile belonging to a club member is similarly equipped, with a transmitter installed in the luggage trunk and a receiver mounted under the dashboard. Soon after the sailplane takes off on a practice flight, the pilot or his passenger in the two-place ship makes radio contact with the club automobile, which is ready to speed to the sailplane's assistance in case it is forced to land at a remote point by lack of winds or suitable air currents of the "thermal" type. The radio equipment is also valuable for communicating advice and criticism from a ground instructor to a fledgling pilot in the air.



Aided by the driver's weather and wind reports, the pilot completes his long flight miles from his starting point. The car, following his flight on the ground, soon comes up to give assistance after the landing

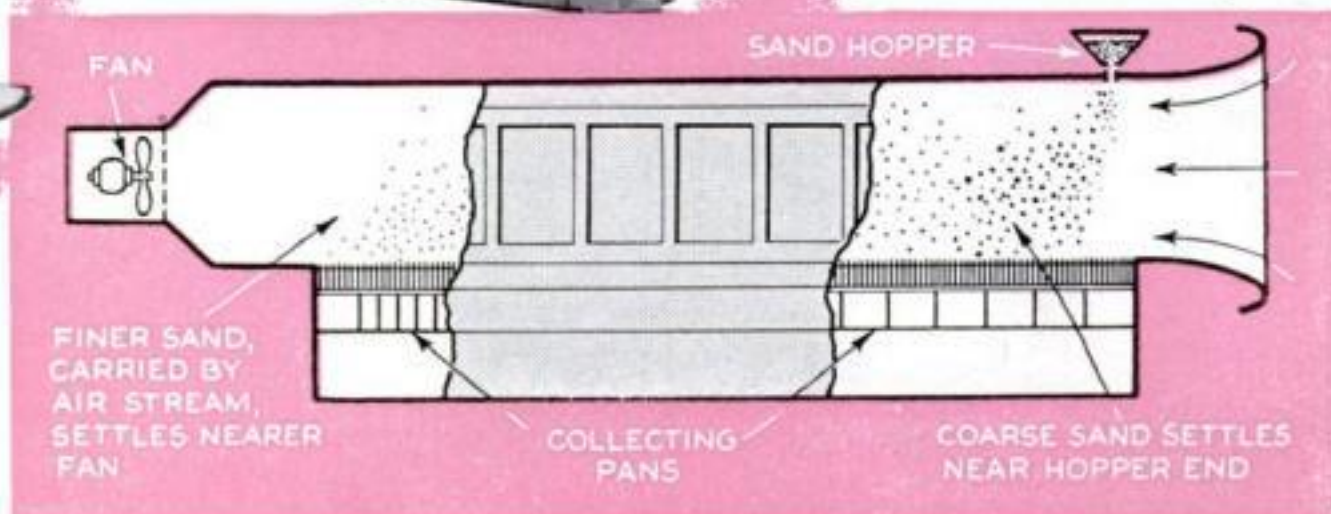
By
JOHN E. LODGE



Pouring sand into the midget wind tunnel to separate the grains according to the size



Plan of the apparatus used for sorting sand



BATHTUB ENGINEERS MAP WAR on EROSION

SLASHED by rains and floods, fertile American farms are slowly being washed away. Each year, as water and wind ravage the land, thousands of acres of rich earth are laid waste by erosion, and rivers act like sewer drains to sap away the fertility of the land. How can this staggering loss be stopped? How can man buck nature and win?

These are the problems that face engineers in a Pasadena, Calif., laboratory where science is ferreting out the secrets of nature,

solving many of her most perplexing riddles, and mapping a war that eventually must be fought in every corner of the nation to protect our farms and watersheds against the relentless attack of erosion.

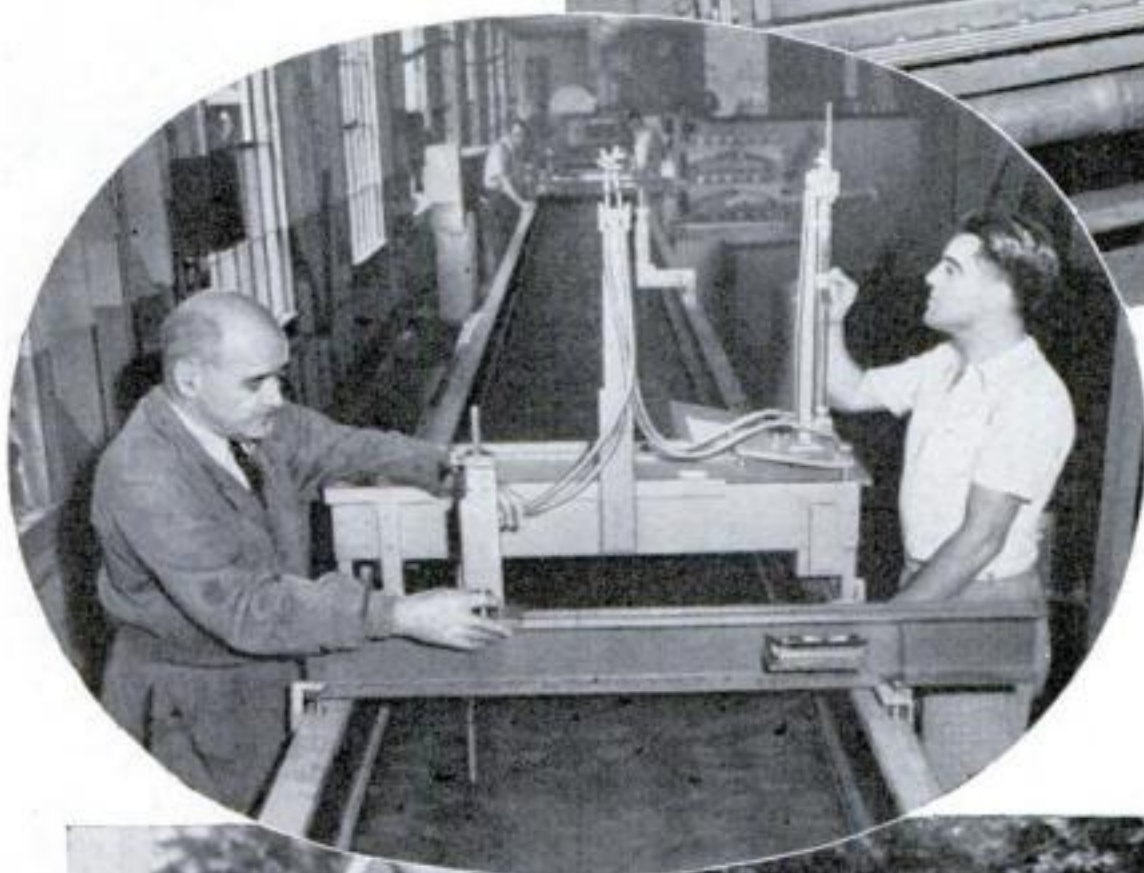
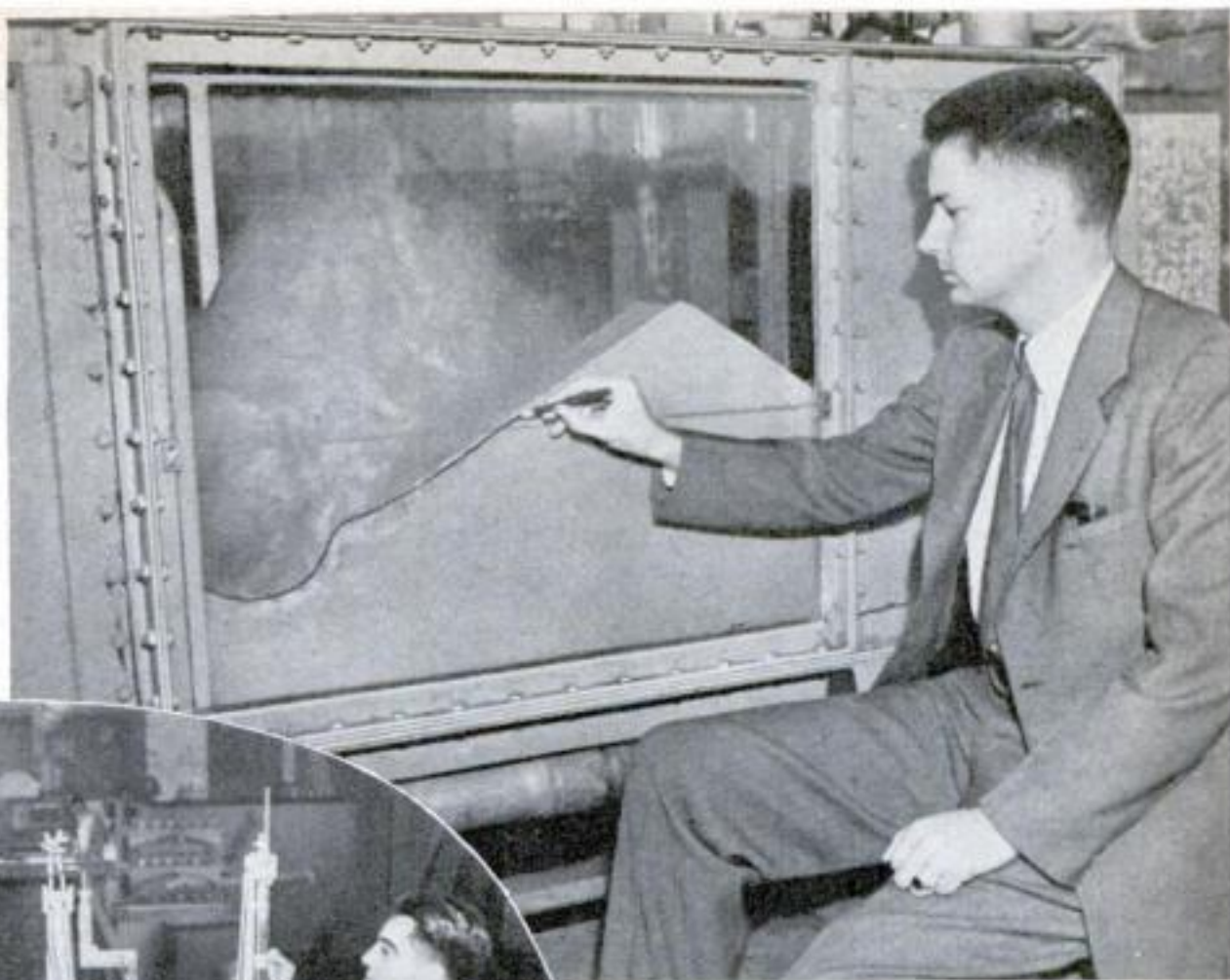
Through the magic of ingenious laboratory apparatus, scientists of the U. S. Soil Conservation Service and the California Institute of Technology peer into the depths of miniature, man-made rivers and reservoirs, chart the scouring action of sand in glass-walled channels, and measure the amount

HOW SAND WASHES

In this glass-walled tank, representing a spillway, experts observe the effect of falling water on sands of various kinds. Marks made at intervals on the glass show how the level changes

MINIATURE RIVER

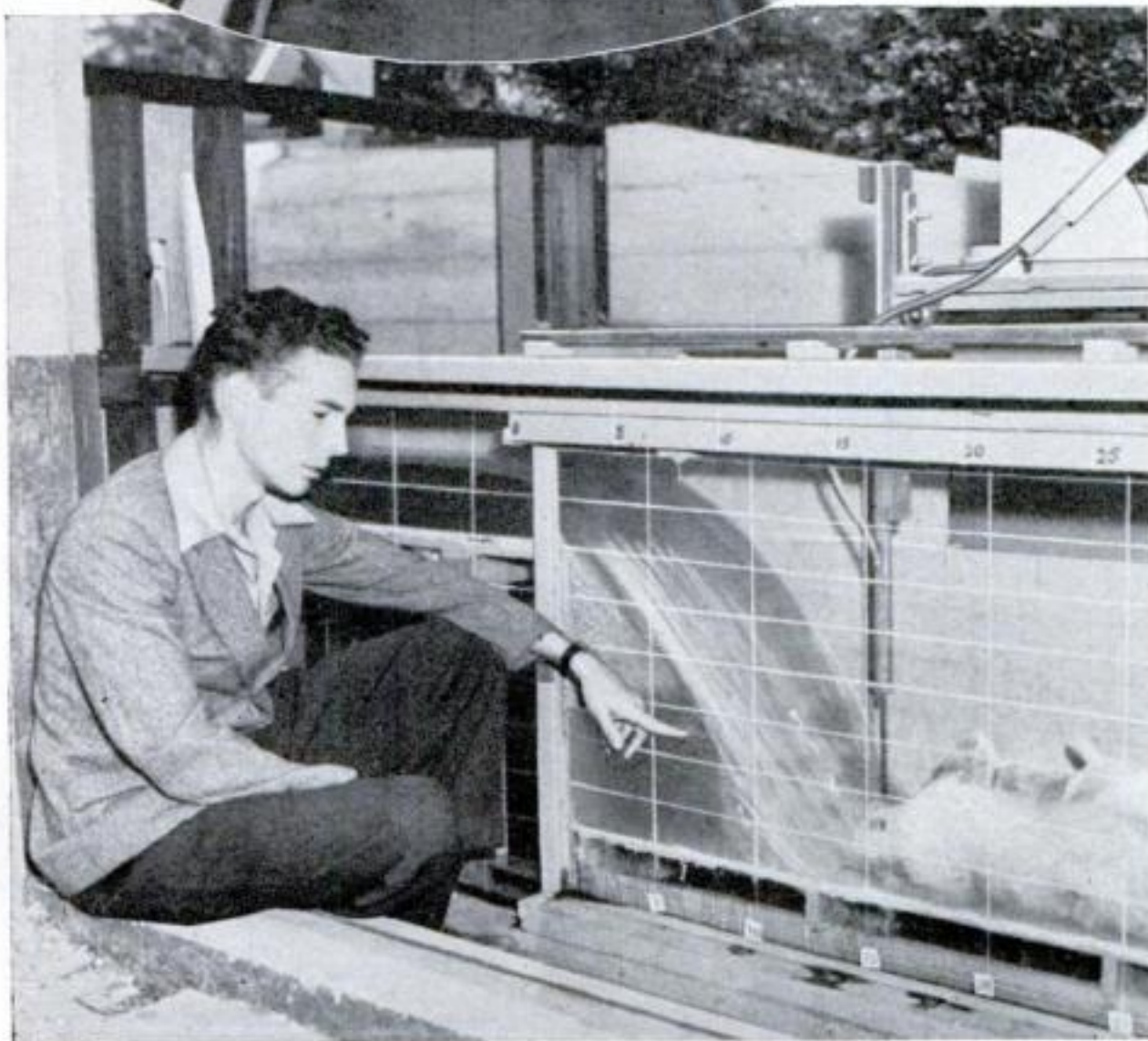
The rubber-lined trough below enables experimenters to determine how much sediment of a given kind water can carry at various speeds



and speed of water-borne sediment rushing down the rubber-lined bed of a narrow steel watercourse.

Taken together, these and other investigations will, it is hoped, reveal how streams pick up their loads of debris, how they carry their heavy burdens, and where they drop them again. Already new facts important to an understanding of nature's mysterious processes have been discovered. Every year, engineers estimate, enough silt flows into Lake Mead to cover 100,000 acres to a depth of one foot, a rate that if allowed to continue might by 2239 completely fill the huge reservoir formed by Boulder Dam. Do these tiny particles move in a riverlike stream under the surface for long distances? How are they building up the bottom of the big lake?

A basic unit of the equipment used in the Pasadena erosion laboratory is a curious wind-tunnel sorter where silica sand employed in many erosion

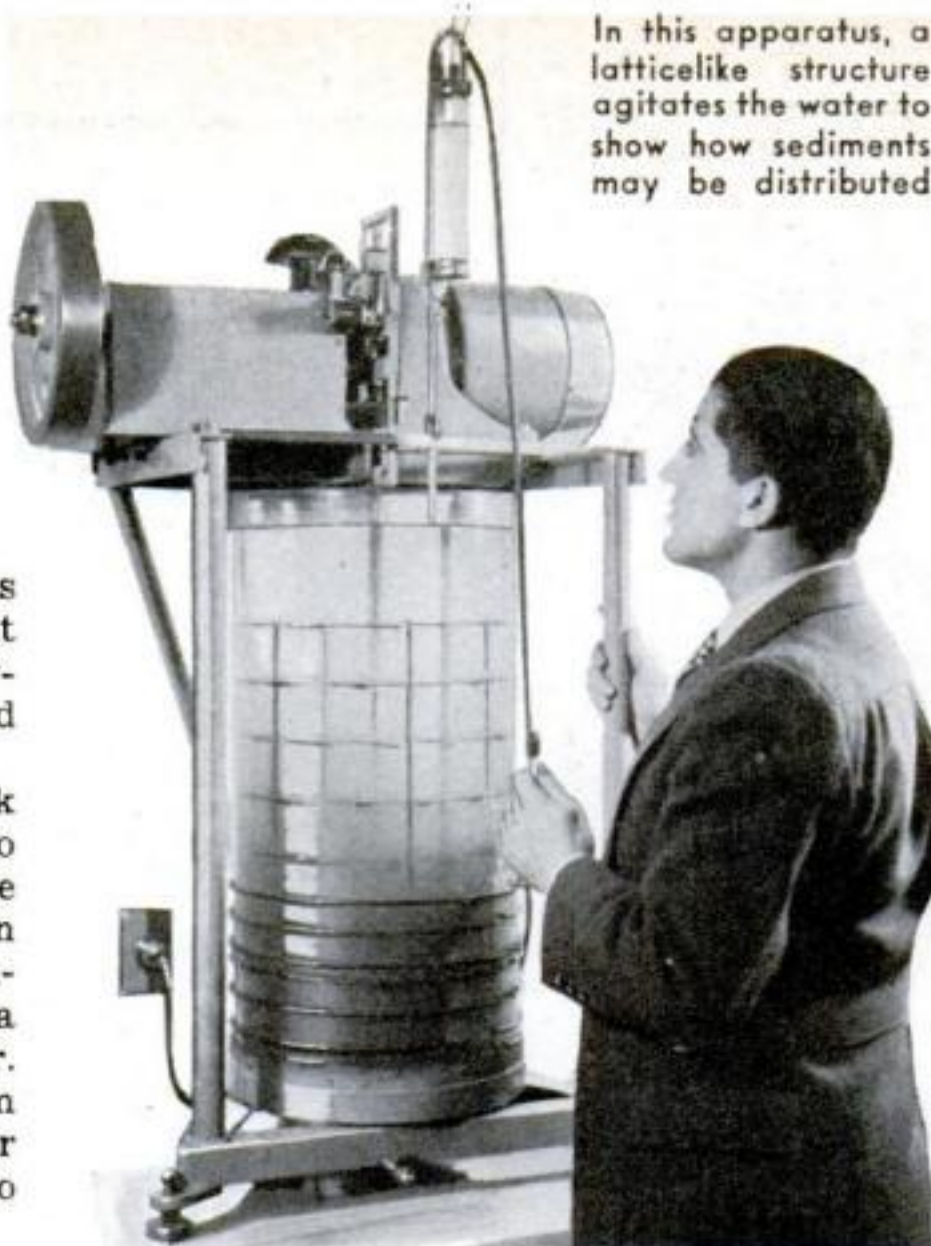


Model spillway for measuring force of falling water at various points. Such studies may lead to the development of a "universal" erosion dam

experiments is classified, not by the ordinary sieving methods, but according to the speed with which it settles in an artificial two-mile breeze. Fed into a hopper at one end of the twelve-foot wind tunnel, sand is sucked along in air currents created by an electric fan, and drifts down into sorting pans lining the tunnel bottom, the heavier grains settling near the hopper mouth and the lighter ones being carried to pans farther down the tunnel.

Sorted sand may then be transferred to a steel-walled river, thirty-three inches wide and twelve inches deep, where, as it moves along with the flowing water, observers constantly check its distribution and settling characteristics.

Yet these varied studies of erosion mark only the beginning of the work. For air also causes tremendous damage by lifting loose topsoil off the land, carrying it overland in great clouds, and depositing it in an unwanted flood of dust. However, the Pasadena technicians, according to their director, Dr. V. A. Vanoni, are sidetracking that problem until they untangle the mysteries of water erosion and provide a practical solution to halt its ravages.



In this apparatus, a latticelike structure agitates the water to show how sediments may be distributed

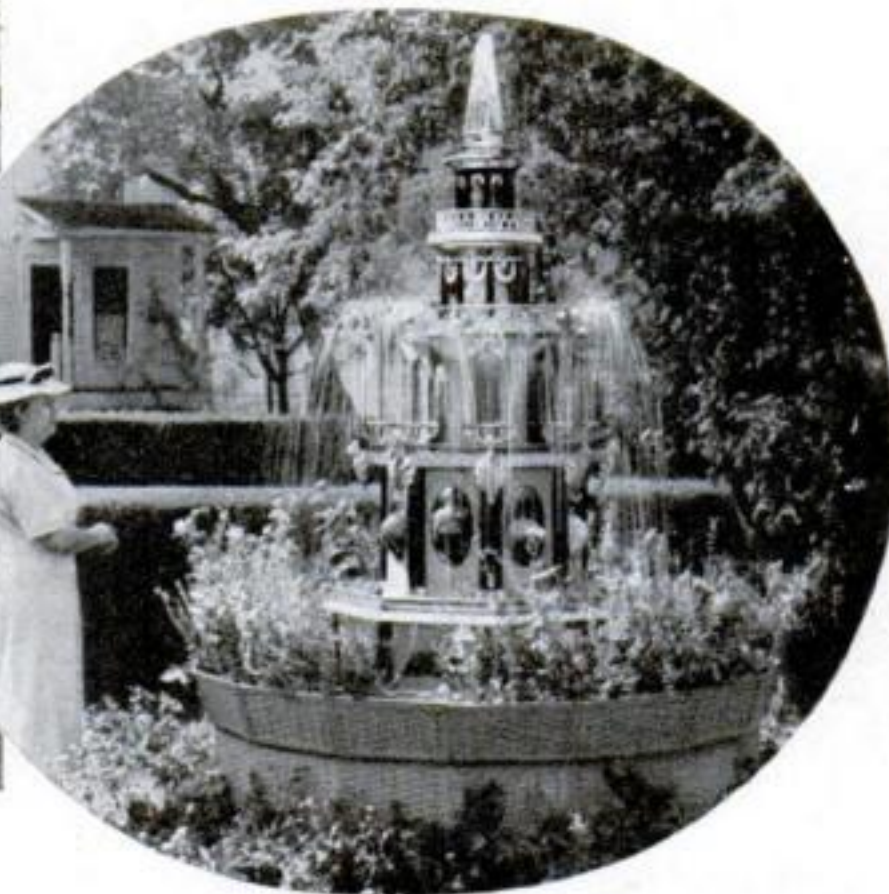
Pergola and Fountain Made of Plastics

STRIPS of thin plastic material woven in a basketlike pattern form a novel garden pergola erected on a lawn in Jamestown, N. Y.,

by Nicholas Demikoff, a machinist whose hobby is large, elaborate projects using plastic materials. As a companion piece to the oriental pergola, Demikoff built a plastic fountain, elaborately decorated and fitted with several tiers of jets. Raw materials for the projects were obtained from a firm manufacturing plastic articles, which let Demikoff help himself to scraps.

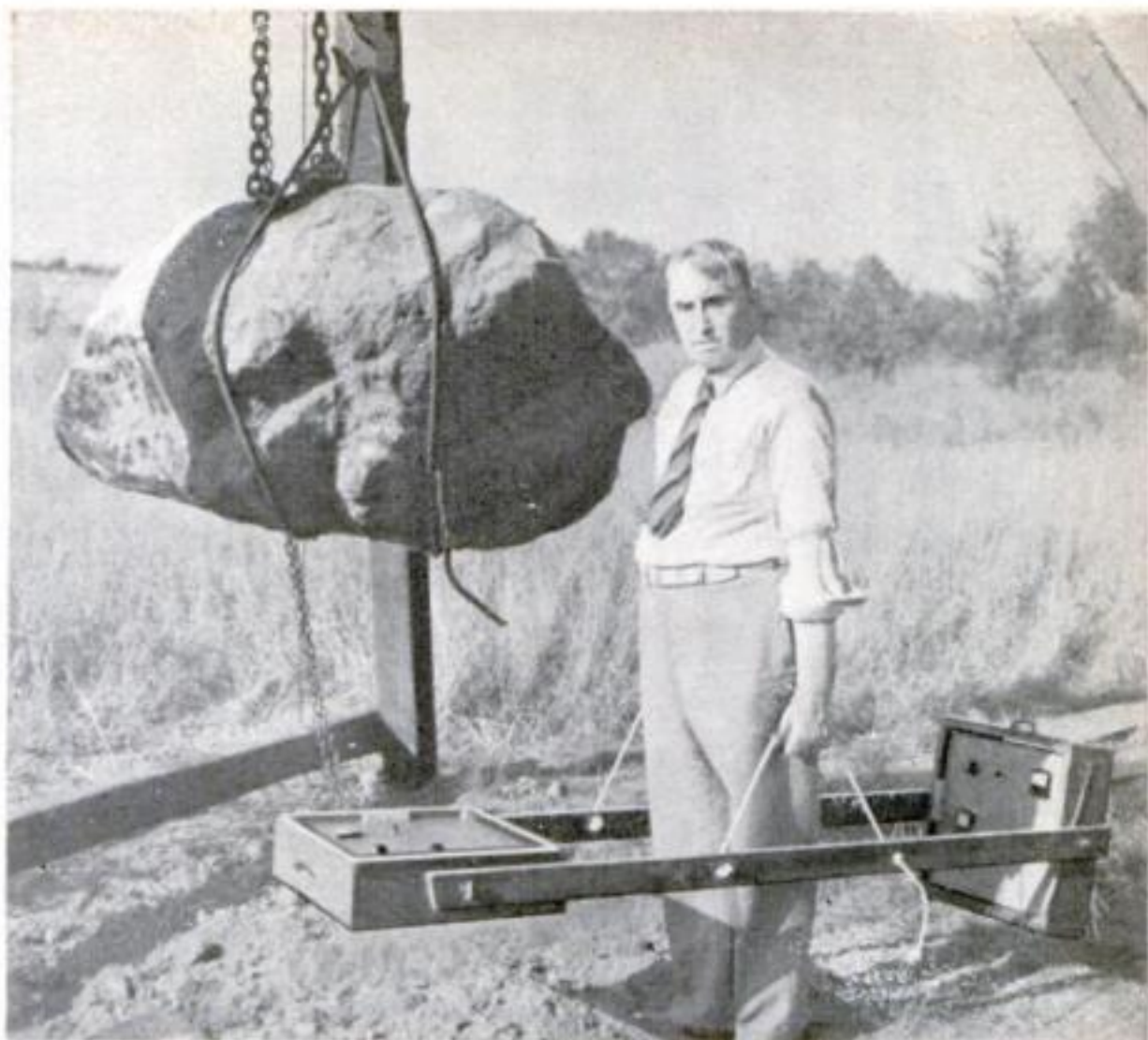


Woven strips of plastic materials form this oriental pergola. Fountain at right is also made of plastics

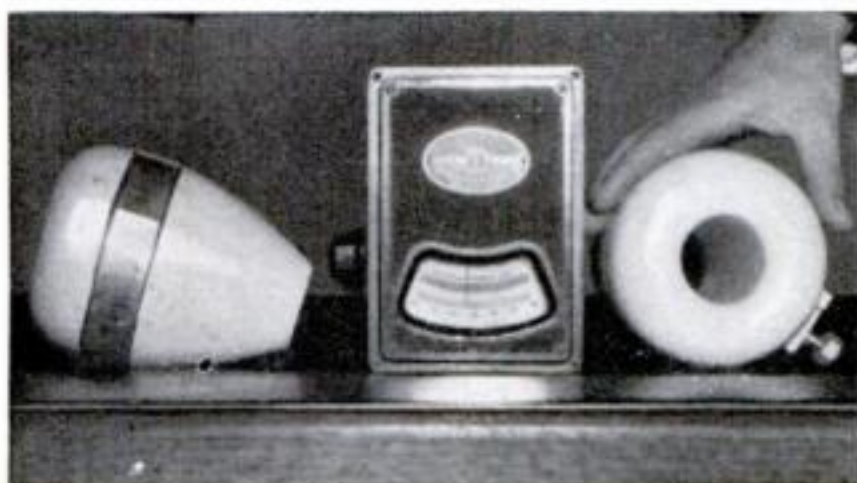
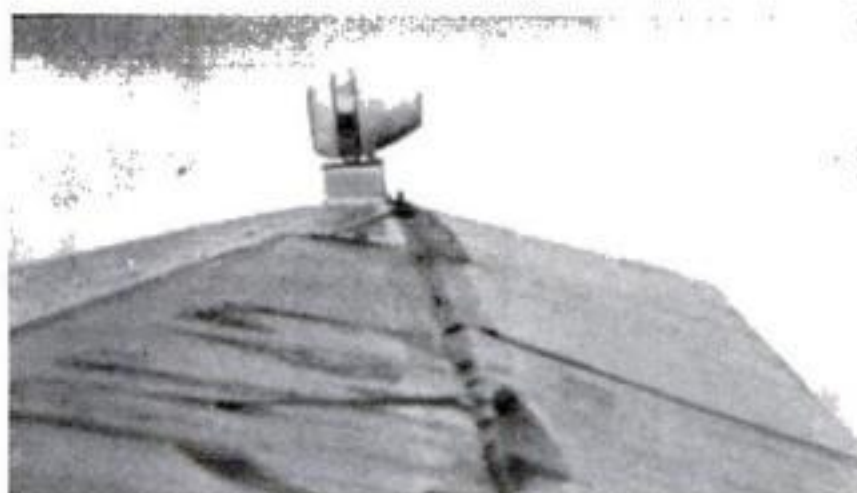


Record-Size Meteor Found by Reader

CALLED the largest ever seen to fall and subsequently recovered in this country, a meteorite that landed in Quincy, Ill., some fifty years ago has just been located by Loren C. Cox, **POPULAR SCIENCE** reader, using a metal-locating device of his own design. Cox, whose hobby is meteors, found that the one-ton object consisted of sandstone and iron. A professional rigger lifted the huge stone into a truck which transported it to the front lawn of Cox's Quincy home for study and display.



L. C. Cox with the recovered meteor and his electric metal locator



Glider "Thermal Sniffer"

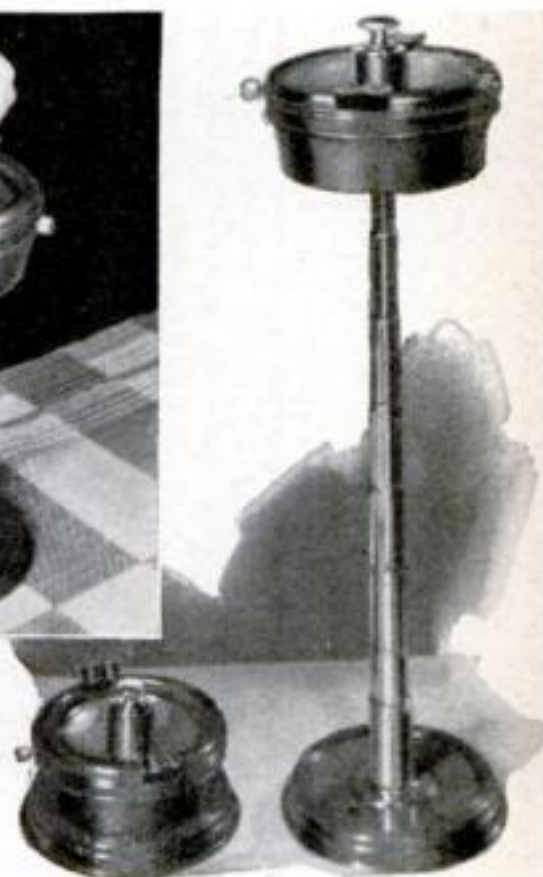
MEASURING temperatures at the tip of each glider wing to within one tenth of a degree, and transmitting their average or mean to an instrument in the cockpit, are the purposes of the "thermal sniffer" shown above. So important are air-temperature changes in gliding that the device, developed by Gustave Raspet, University of Maryland student, is considered a gliding boon.

Telescoping Ash Tray Sits on Floor or Table

TWIRLING a knob on the top of a new ash receiver permits its stand to be lengthened or shortened and then locked in position for use either as a table or floor model. The stand consists of telescoping metal tubes set in a circular, weighted base. The tray proper has a false bottom which can be opened by means of a button for dumping ashes into an inner container.



When the button at top is turned, the ash receiver can be extended or made shorter



Fighting the Air

THREE miles above the Army proving grounds at Aberdeen, Md., a 300-mile-an-hour pursuit plane streaked at full speed across the sky. It towed a sleeve target, resembling the "wind socks" used at airports.

With cotton stuffed in their ears, spectators watched the Army's latest antiaircraft gun go into action. Supersensitive shells, detonated by contact even with fabric, rocketed into the air at the rate of 120 a minute from the thirty-seven millimeter (inch and a half) weapon. A few seconds later, there was a direct hit and the target vanished.

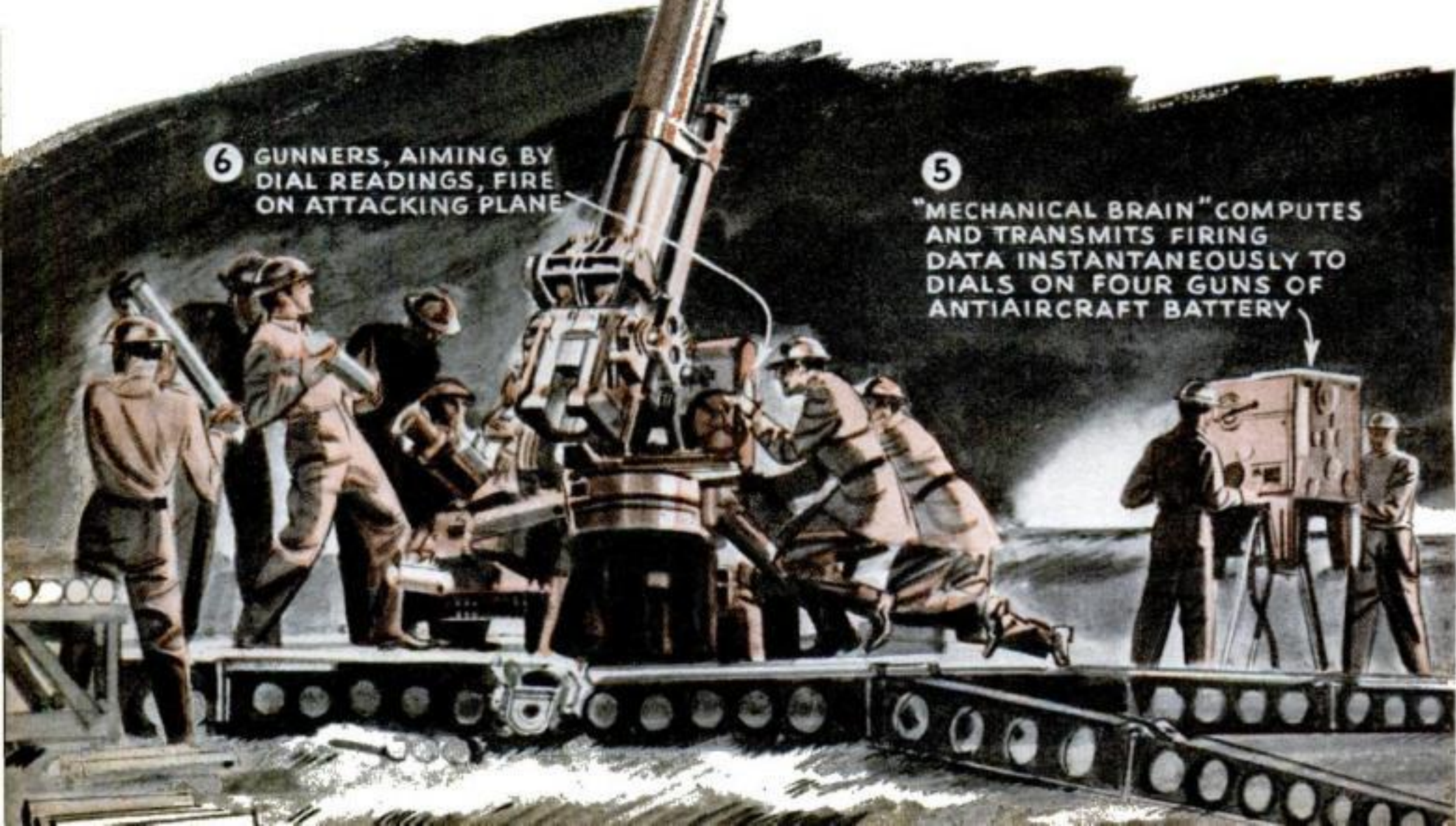
Modern antiaircraft artillery, as exemplified by guns like this, has turned the tables on the air raiders. No longer can bombers ignore ground defenses, while raining death from the sky. Figures from European battlefields show that only one enemy plane was brought down by antiaircraft fire, in the last European war, to every five shot down by pursuit craft—but today that proportion has actually been reversed. One reason is the amazing improvement in range, mobility, and speed and accuracy of fire in antiaircraft guns developed since 1918. The other is the innovation of "director" fire control, a method of aiming the guns electrically, which

**Improved Weapons for
Antiaircraft Defense
Meet the Menace of
Destructive Attacks
on Our Great Cities**

**By ALDEN P.
ARMAGNAC**

6 GUNNERS, AIMING BY
DIAL READINGS, FIRE
ON ATTACKING PLANE

5 "MECHANICAL BRAIN" COMPUTES
AND TRANSMITS FIRING
DATA INSTANTANEOUSLY TO
DIALS ON FOUR GUNS OF
ANTIAIRCRAFT BATTERY

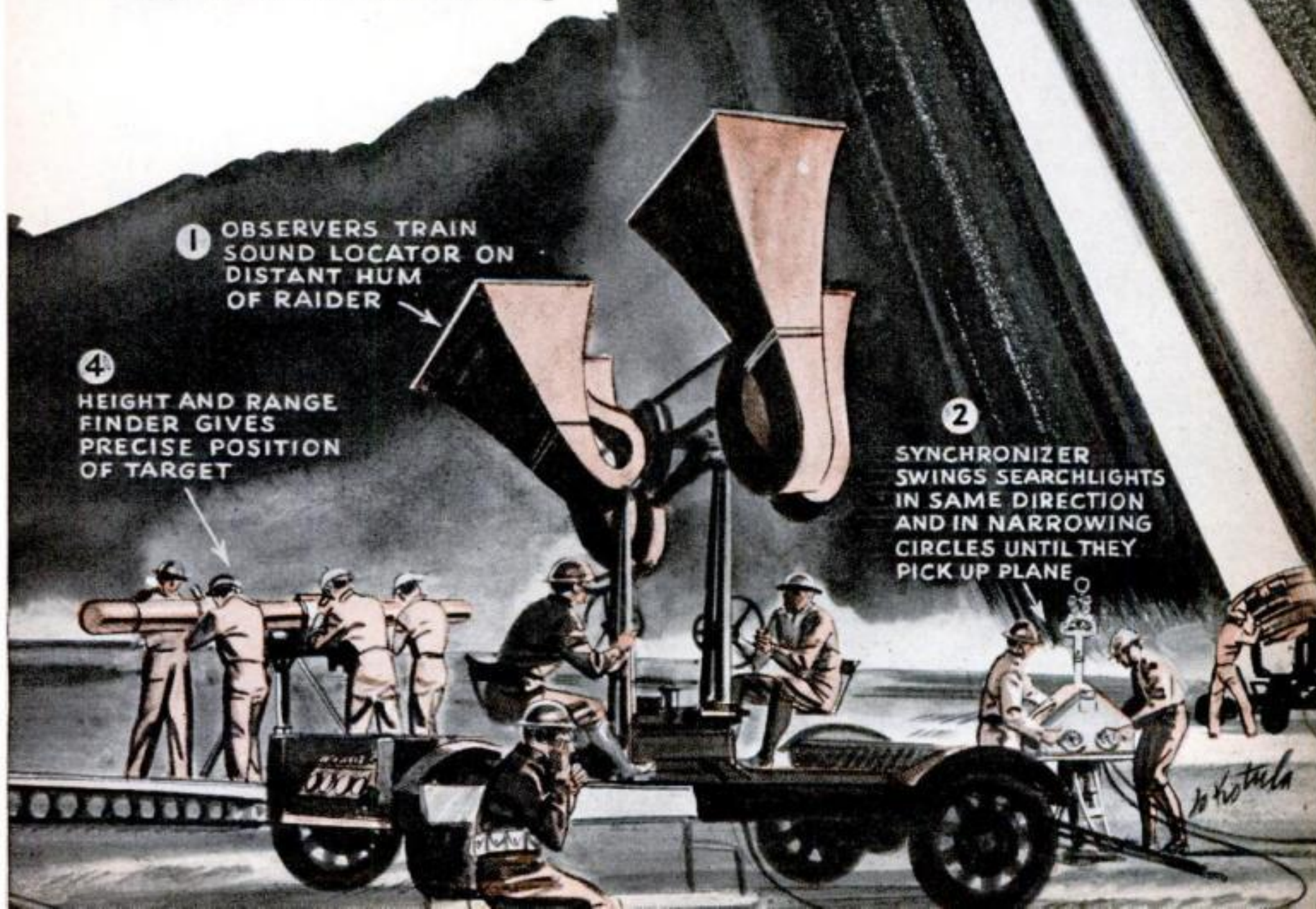


Raiders

has been developed to its highest degree of perfection in this country.

How the new "director" system works, in conjunction with a battery of four mobile guns that can be rushed to any threatened locality, is shown in an accompanying drawing. First warning of an approaching raider comes from a sound locator, whose great horns pick up the distant hum of motor and propeller. Observers train it on the source of the sound, and, at night, powerful searchlights swing simultaneously to pick up the craft for the gunners.

Then a trained crew brings into play an optical height and range finder, from which a trailing electric cable leads to a "mechanical brain"—a lightning calculator which automatically computes the firing data for the guns of the battery. Gunners waste no time by even glancing at their target. Reading dials mounted right on their guns, they aim the pieces accordingly, and a burst of devastating



① OBSERVERS TRAIN
SOUND LOCATOR ON
DISTANT HUM
OF RAIDER

④ HEIGHT AND RANGE
FINDER GIVES
PRECISE POSITION
OF TARGET

② SYNCHRONIZER
SWINGS SEARCHLIGHTS
IN SAME DIRECTION
AND IN NARROWING
CIRCLES UNTIL THEY
PICK UP PLANE

③ SEARCHLIGHTS
ILLUMINATE PLANE

fire greets the hostile aircraft. The system works with such precision, experts declare, that it would be considered poor gunnery if more than fifteen shells were required to bring down a plane flying three miles high!

Except for larger, fixed anti-aircraft guns that defend vital outposts like Hawaii and Panama, the Army's standard weapon against high-flying planes is its mobile three-incher, of which more than 300 have recently been completed and many more are on order. Its shell, preset by a time fuse to explode at any desired altitude, wrecks a hostile craft with shrapnel.

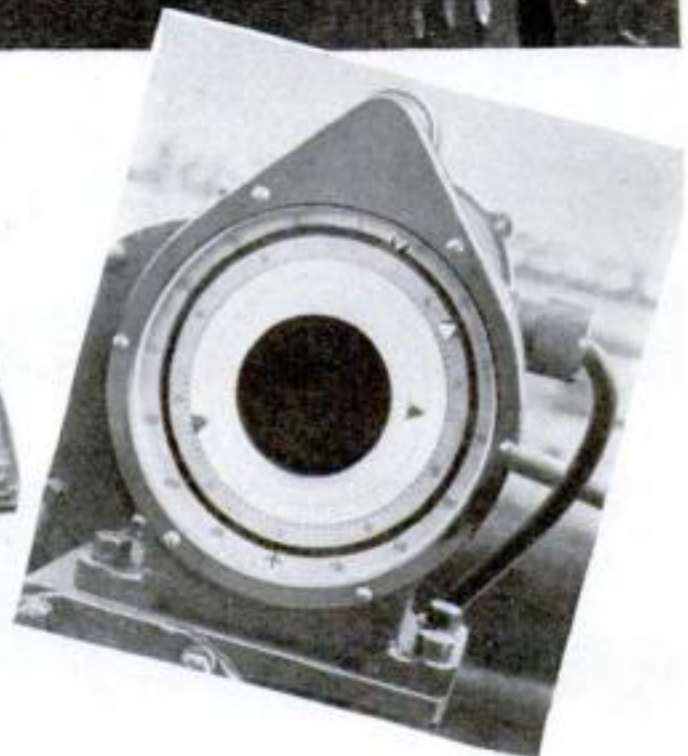
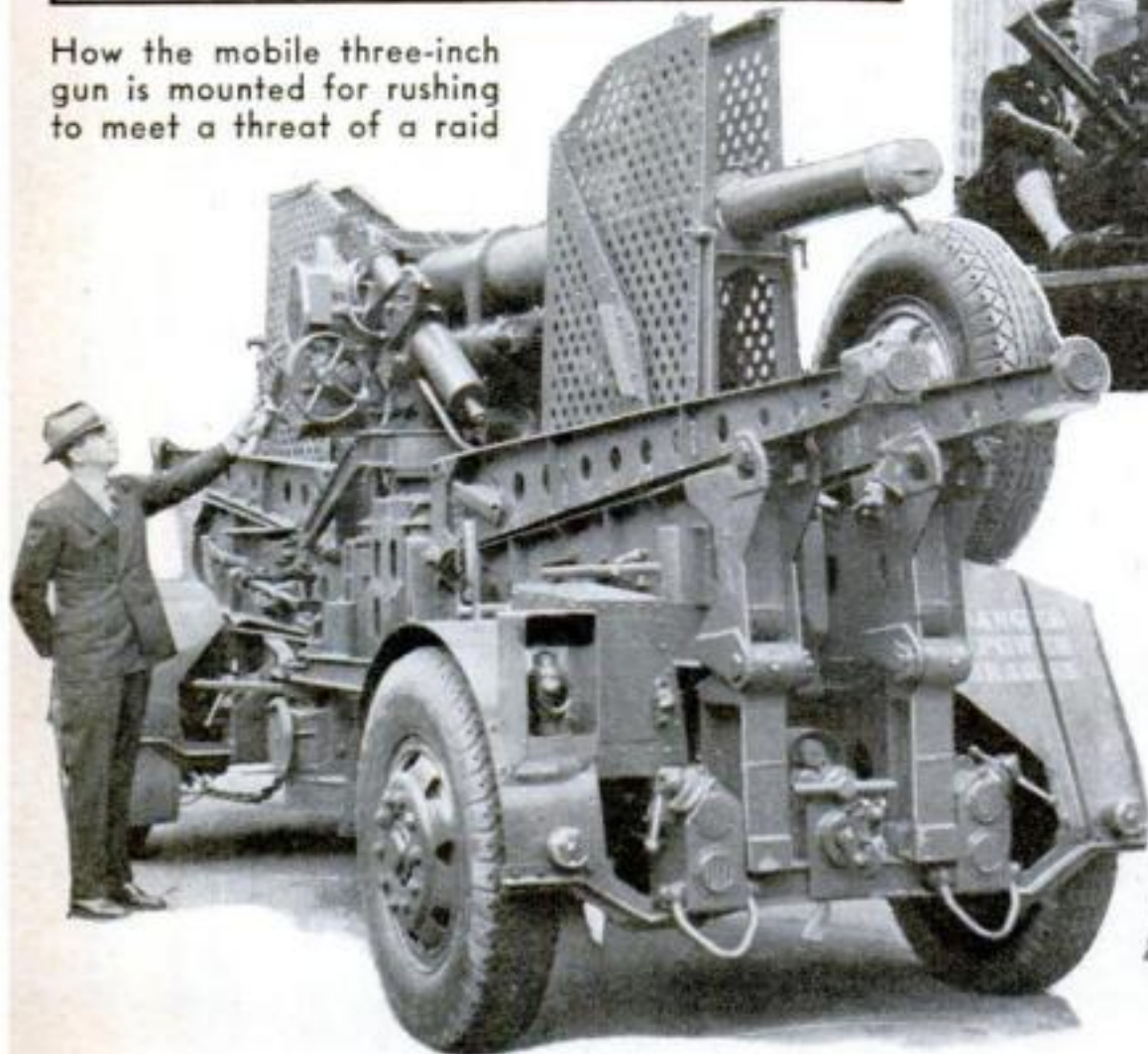
For use against lower-flying aircraft, "pom-pom" and "multiple pom-pom" guns are a modern innovation. From clips or other automatic mechanism, they fire a stream of 1½-pound explosive shells—projectiles small enough to slip in your pocket—with almost machine-gun rapidity. A direct hit explodes a shell of this type. If it misses its mark, it destroys itself harmlessly while still in the air. The U. S. Army's version of this potent new weapon, its new thirty-seven-millimeter gun, can be adapted to the same "director" control as the larger anti-aircraft artillery.

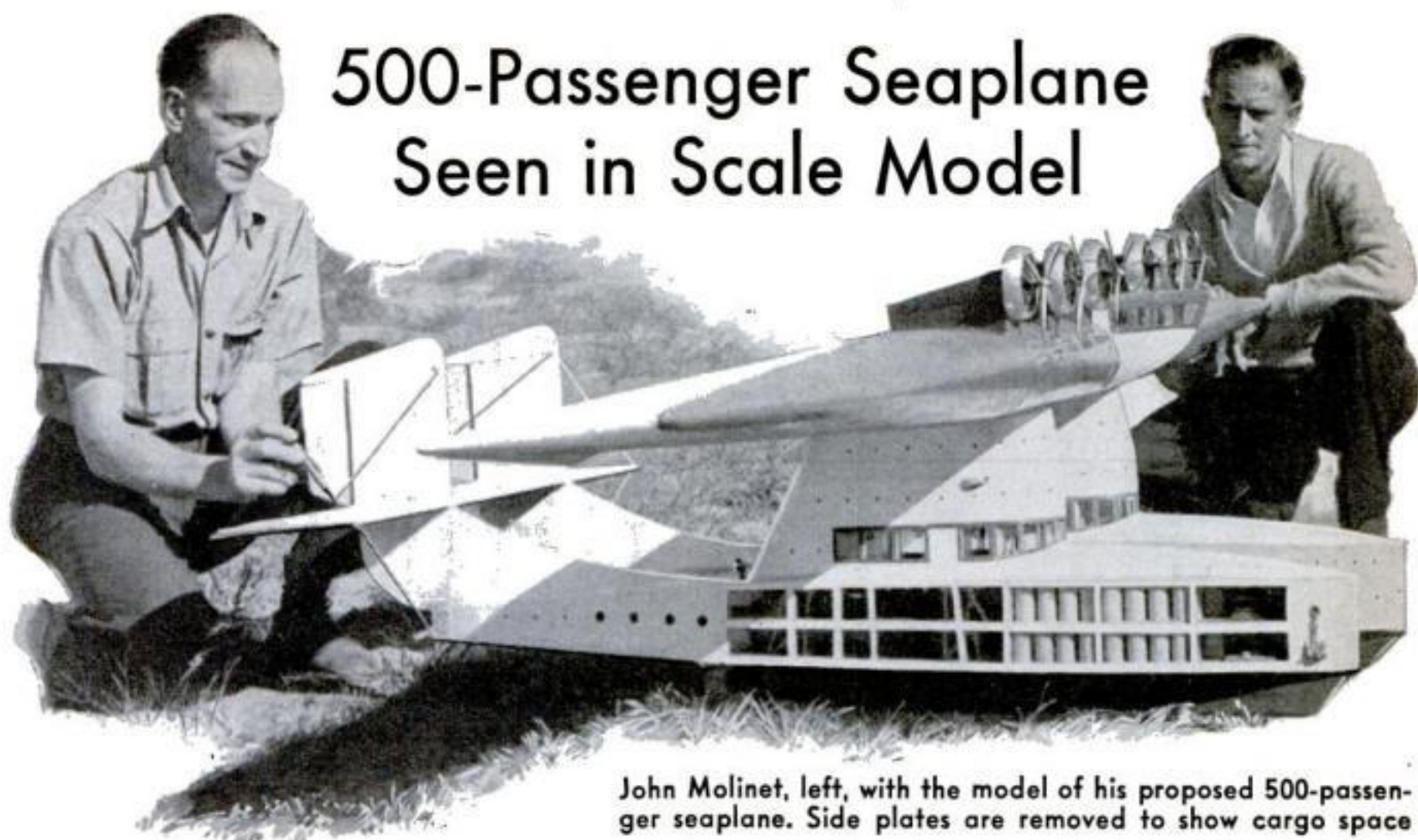


Three-inch anti-aircraft gun ready for action. Gunners get the range from a dial like that seen below



How the mobile three-inch gun is mounted for rushing to meet a threat of a raid





John Molinet, left, with the model of his proposed 500-passenger seaplane. Side plates are removed to show cargo space

DESIGNED to race across thousands of miles of open ocean at a top speed of 200 miles an hour, a gigantic seaplane conceived by John Molinet, of Rosedale, N. Y., is pictured in the photograph above in scale-model form at the U. S. Coast Guard Base at Floyd Bennett Field, New York City. Large enough to accommodate 500 passen-

gers, the mammoth twin-hulled craft would have screw-type propellers fitted to its hull which would drive it over the surface of the water at a speed of thirty knots, the inventor claims. In the air, the plane would be propelled by six electric motors, running on current produced by generator units burning fifty gallons of fuel oil an hour.

Dummy Flags Customers for Service Station



Oscar on the job. At the right, he is getting a shot of oil in the arm. Note the storage battery that gives him pep



PAINTED to resemble a uniformed attendant, Oscar, a life-size dummy set up in front of a Los Angeles, Calif., service station, waves one arm up and down as a means of attracting the attention of passing motorists. Made of sheet metal, the waving arm is pivoted to a body cut from five-ply wood and operated by a mechanism made from a truck-type windshield wiper powered by a six-volt storage battery, which, placed at the base, helps to keep Oscar from blowing over.

Hair-Do Cut-Outs Help Choose Coiffure



One of the variety of coiffure masks designed to show hair styles

How will a new hair-do look? The slip-on card shows her at a glance

TWELVE different styles of hairdress printed in color on cardboard cut-outs enable anyone to judge in advance which style of "hair-do" is most flattering. Held so that the cardboard coiffure fits around the

the user can duplicate the most becoming style after it has been determined by means of the cut-outs, rather than by time-consuming actual trial. Both blonde and brunette masks are available.

Emergency Tools Stored in Air-Raid Shelter

IN PREPARATION for possible air raids, German defense officials in Berlin have outfitted underground shelters with complete sets of tools for use in emergencies. In the photograph at the right, above the fire extinguisher and buckets on the floor may be seen a rack containing a shovel, ax, pick, hammer, and other tools.

Fresh Pineapple Juice Has Medicinal Value

FRESH pineapple juice has an important medicinal value according to two University of Wisconsin research scientists, Julius Berger and Conrado F. Asenjo. The juice, according to tests, contains a substance called bromelin which is not poisonous to man but can destroy certain types of parasitic, disease-causing worms. Classified as a type of "enzyme," a complex substance that may produce changes in other substances without changing itself, the bromelin, after test-tube experiments, gave promise as an effective worm medicine. Directions for use of the new remedy have not been announced.



Useful implements, ready for use in any emergency

How To Gather Star Dust

HOW MUCH star dust drops from the sky onto the earth every year? That is the problem being tackled by Harvey H. Nininger, Denver, Colo., meteorite expert, who has devised a meteorite-dust measurement system that anyone can follow. To try it yourself, obtain several small aluminum pie pans, a few small magnets, and a thin rubber bathing cap. After a heavy rain has washed the dust on your roof down through the gutters to the downspout outlet, cover a magnet with the rubber cap and collect some of the metallic material that has washed down. Viewed

through a microscope, the star dust will be revealed as tiny spherical particles. When the next heavy rain comes, place under each down spout an aluminum pan set on top of a magnet. Meteorite dust washed down from the roof will then cling to the pan. And if there have been, say, twelve days since the previous rainfall, the total amount of dust collected, divided by twelve, will give you a rough daily average of the quantity of star dust that settled on the roof during that period. Nininger reports an average daily dust fall of about seven milligrams to an area of four square rods.



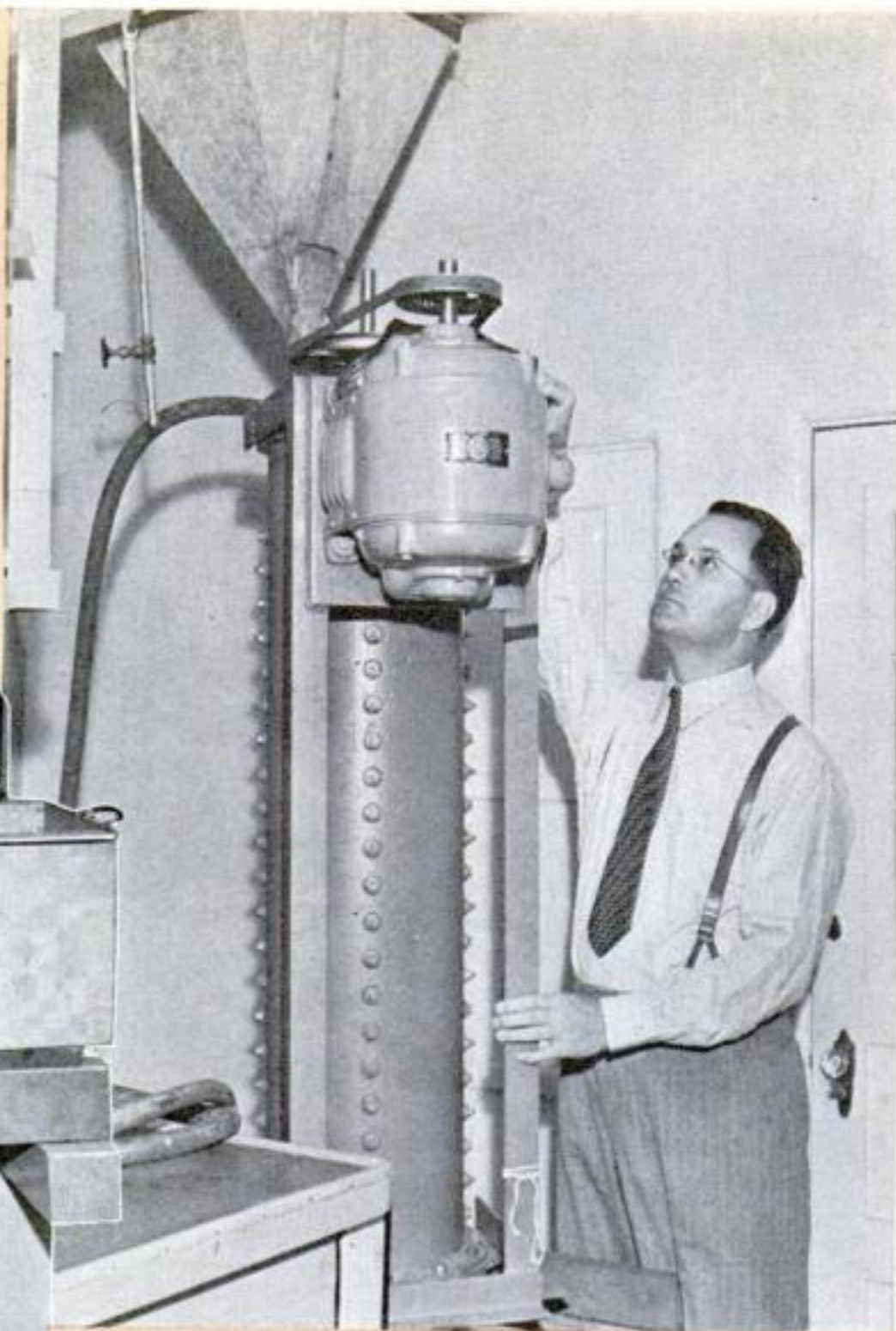
A 2,573-pound meteorite found in California. Such "shooting stars" continually drop dust on the earth



Collecting meteorite dust. The metal pan, set on a magnet, holds metallic particles washed down the spout. At right, another way of getting samples

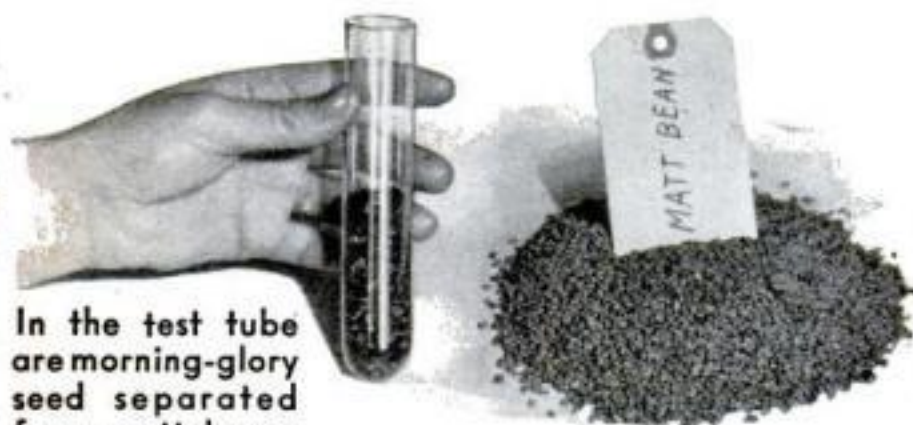


Theodore Earle puts a few drops of chemical reagent in his apparatus which separates good seed from bad



Whirled against baffles inside this tank, wheat is "peeled," or freed of its woody outer covering as it descends through water to the bottom

Amazing Machine Picks Seeds That Will Grow



In the test tube are morning-glory seed separated from matt beans

WORKING secretly for three years in a tiny, vine-covered laboratory at Pacific Palisades, Calif., Theodore Earle, a retired mining engineer, has perfected a startling new process for separating seeds according to their ability to grow. To substantiate laboratory tests, he has made some 1,200 plantings of wheat, barley, sugar beets, corn, carrots, oats, and other farm products at three



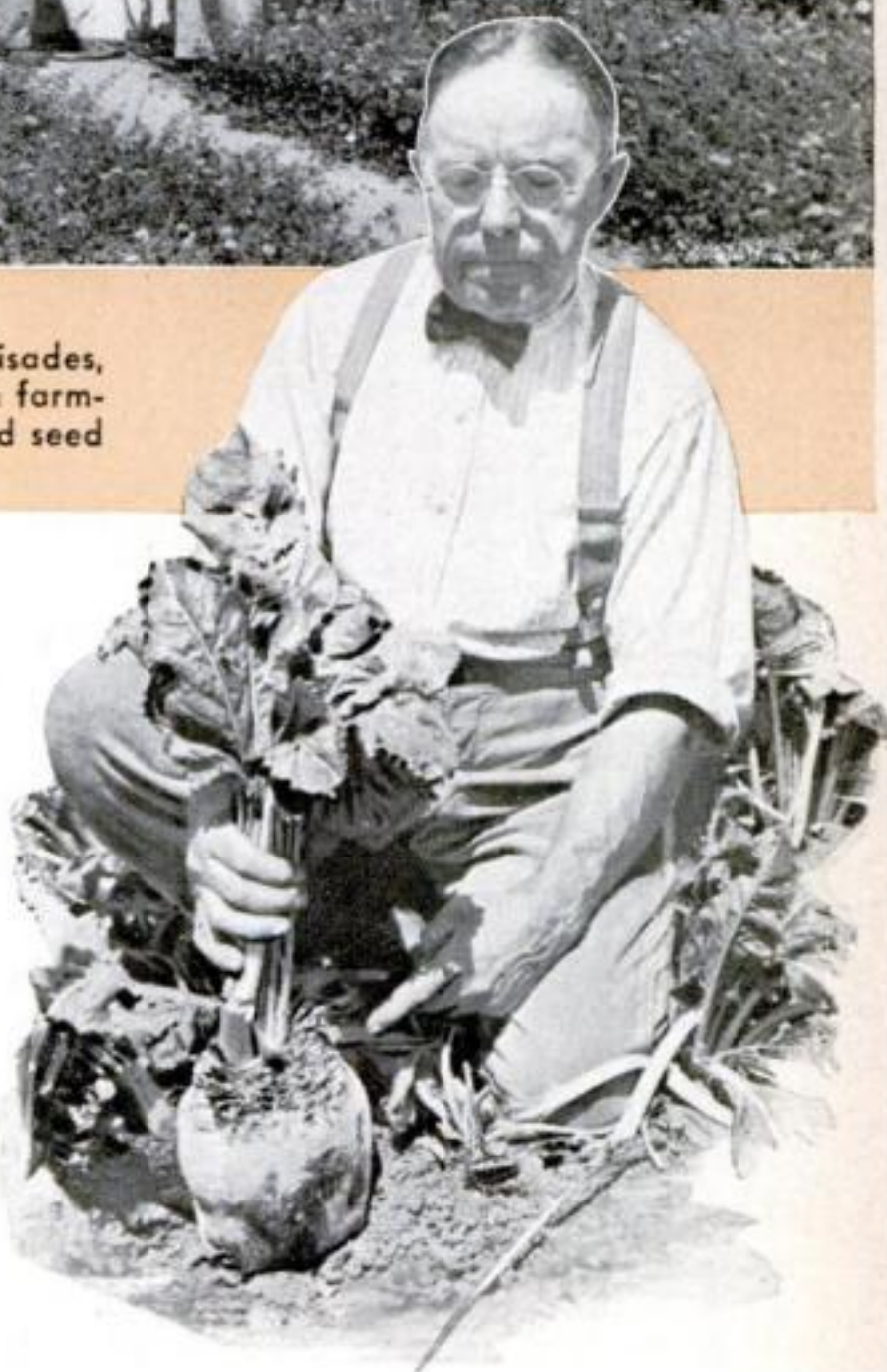
Earle's vine-covered laboratory at Pacific Palisades, Calif., which may be the cradle of a new era in farming. Right, a ten-pound beet grown from selected seed

By ROBERT E. MARTIN

southern California ranches. Increased yields and crops of better quality have come invariably from the "separated" seeds.

Early in 1936, Earle planted blue-grass seed in his lawn. It failed to grow properly, and weeds sprouted in the seeded area. That started the retired engineer on the research which now seems likely to form an outstanding milestone in American agriculture. Earle, who had taken out forty different patents relating to mining, was familiar with the froth-flotation process by means of which gold is separated from baser minerals. It occurred to him that a similar system might be used to separate good seeds from bad.

Into an apparatus filled with water and resembling an electric washing machine, he dumped several pounds of blue-grass seed. After it had become thoroughly wet, he added a few drops of pine oil and set the agitating mechanism in motion. Bubbles formed in the water and a soapy froth covered the surface. Some of the seeds, becom-



ing attached to the rising column of air bubbles, rose to the top and were skimmed off. Others sank to the bottom.

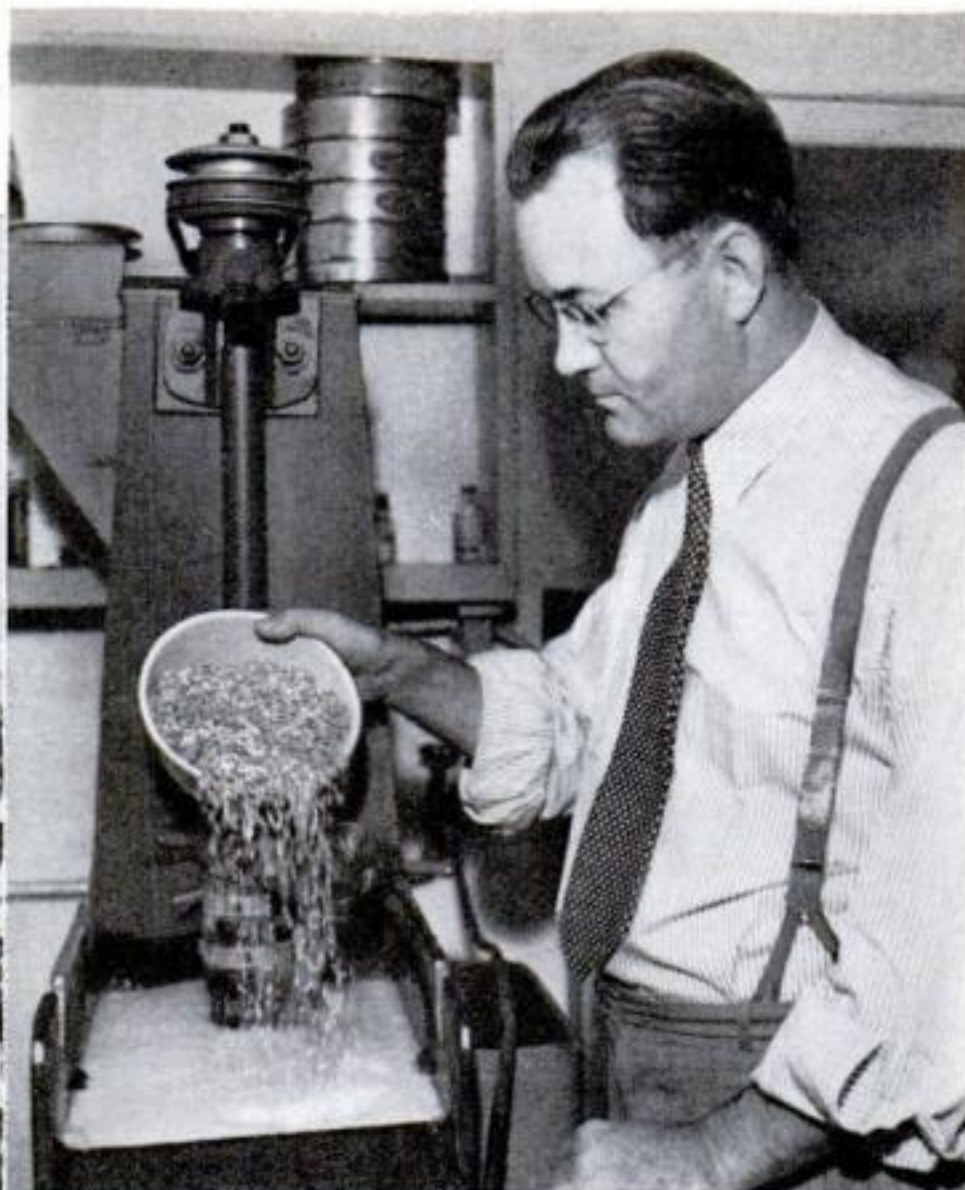
Earle planted both kinds of seed in greenhouse trays and awaited results. The seed which had sunk to the bottom, he discovered, produced a thick, beautiful stand of grass. The seed that had floated, on the other hand,

For practical field tests, the experimenter plants his "separated" seed on the farm of a neighbor, J. C. Perry. The Indian corn below is a sample of the results he gets



produced only spindly shoots or devil grass.

Spurred on by this success, he tried his flotation system on other seeds. He bought wheat, barley, corn, and oats. In each case, the seed which sank produced the strongest plants, and the seed that floated proved least fertile. Exactly why this occurs, the inventor is unable to explain. At first, he thought it was because fertile seeds were heavier. Laboriously, he counted and weighed separated seeds of the same variety. Their weights were often approximately the same. He concluded finally that the chemical composition of the seeds varied and the reagent poured into the water, usually pine oil or synthetic alcohol, had an affinity for the less fertile seeds. As a result they became at-



Pouring barley grains into the frothy mixture in the "separator." When the liquid is agitated, less fertile seeds rise to the top with bubbles

tached to the rising bubbles and were carried to the top.

In his earliest tests, the experimenter divided seeds into groups of 100 each and planted them on moist paper. Later, he used ranch plots where the seeds grew under natural conditions.

Spectacular results reported from the California laboratory, however, are not confined to grains. Plants which sprang from selected muskmelon seed were bearing four weeks after others had died of mildew. Sugar beets grew much larger than their neighbors, many weighing ten pounds before harvest time. And, in a test of carrot seed, Earle found that the good seed produced twenty-one pounds against fourteen pounds from the poor seed.

Other work which Earle's machine accomplishes is stripping the woody coating from wheat and other grains, removing tiny spores of fungus, and eliminating insect-infested seeds. In future years, Earle believes, farmers will harvest wheat, corn, oats, and other grains and then take them to mills where they will pass through giant vats and froth-flotation cells to be separated. The most fertile grain will be sacked for planting in the spring; the rest will be marketed for food.

Milling Attachment for Drill Press

HOME-WORKSHOP craftsmen can do precision drilling and milling on a drill press with the aid of a new unit that resembles a compound-rest assembly on a machine lathe. Nearly seven inches square, the table of the attachment has crossed slots for receiving bolts holding the vise jaws. Feed screws with micrometer adjustments control a maximum table movement of four and a half inches.

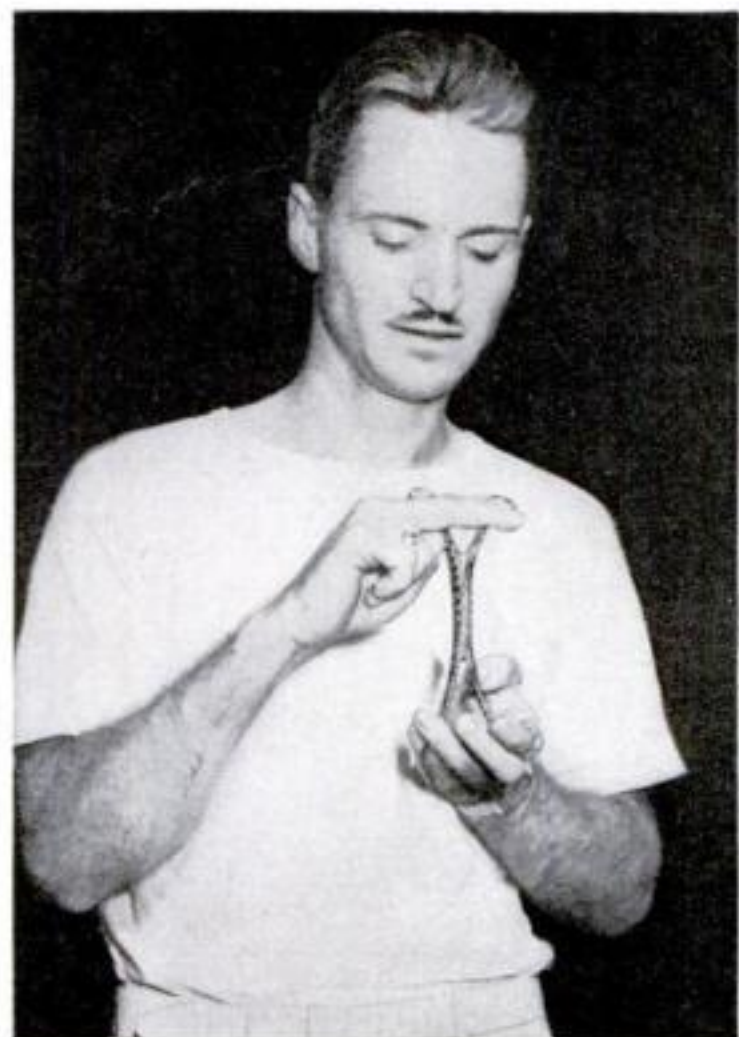


The new milling attachment in place on a drill press. The feed screws give a maximum movement of four and a half inches



Alarm Clock in Rented Plane Tells When Time Is Up

STUDENT pilots, anxious to practice flying technique and build up experience in the air, often forget all about time, and overstay their allotted period aloft, according to Archie Baxter, light-plane operator at Floyd Bennett Field, New York City. To remedy this situation, Baxter, who usually rents his ships out for fifteen, thirty, or forty-five-minute periods, has installed alarm clocks on the instrument boards to ring down the pilots when their time is up.

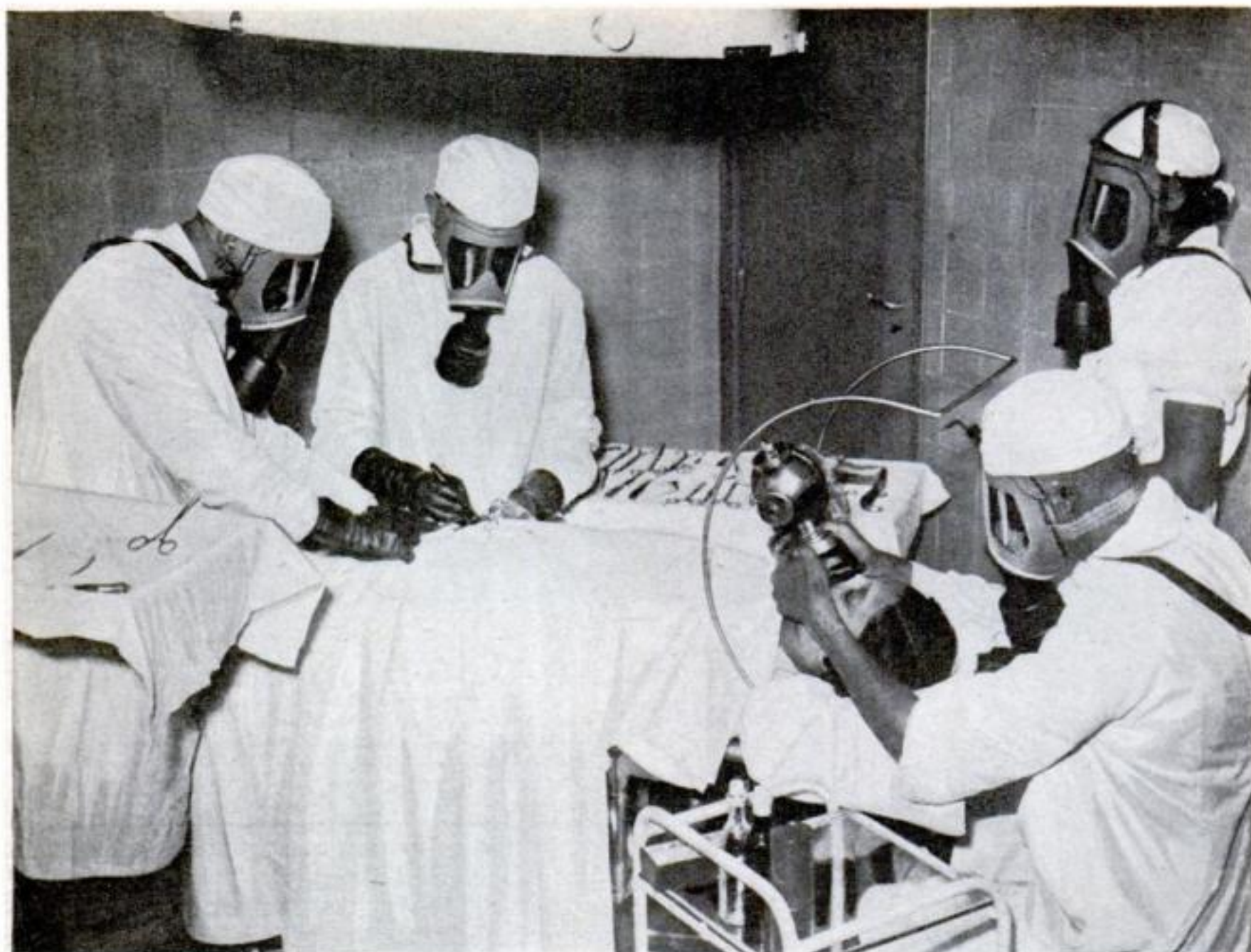


These little snakes have separate heads and tails, but a common heart. Travel presents serious difficulties

Amazing Siamese-Twin Snakes Have One Heart Between Them

SIAMESE-TWIN snakes, one of nature's rarest freaks, were born recently to a diamond-back water snake caught by a University of Michigan zoölogist. The tiny reptiles have separate heads, tails, and spinal columns, being joined together only at the middle. X-ray photographs, however, show that they have one common heart. Their actions are not coördinated, and they frequently get tangled up, when one wants to head north and the other has a fixed idea about going south.

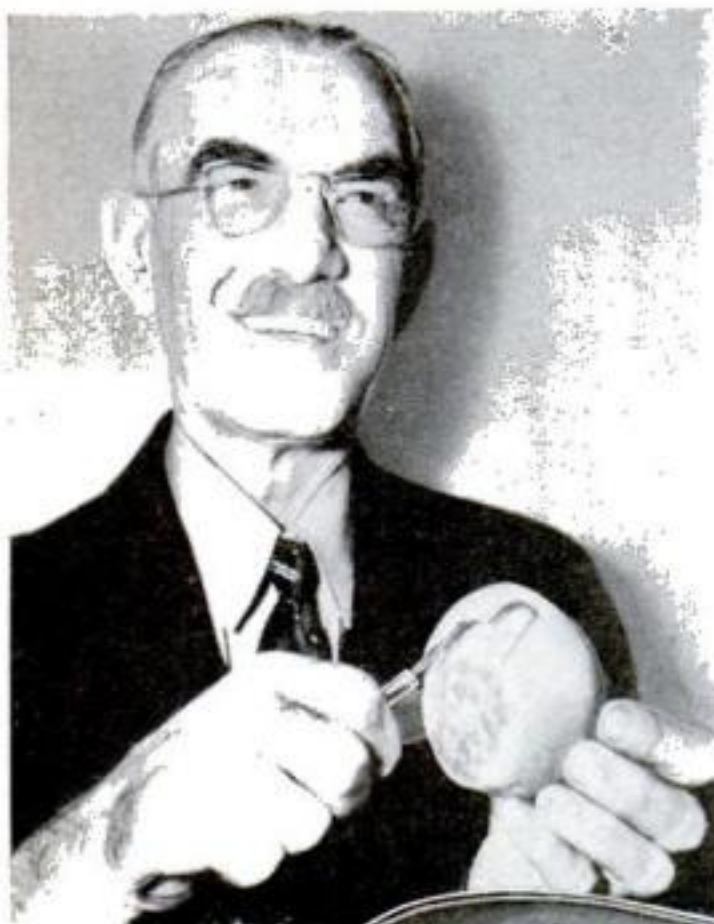




Surgeons Rehearse Gas-Raid Operation

WHAT would happen if surgeons were forced to conduct an emergency hospital operation during a wartime gas raid by enemy airplanes? To prepare for that pos-

sibility, French doctors in Paris recently conducted a major operation, with the patient, as well as surgeons, assistants, and nurses all wearing gas masks.



Fastidious Orange Fancier Invents Messproof Peeler

POPEYE the Sailor never relished spinach more than Paul J. Ouellette, Pasadena, Calif., diamond setter, likes oranges. But while the brawny cartoon sailor man has little difficulty getting at his muscle-building greens, Ouellette always had trouble skinning an orange without having the juice rain onto his clothes and the peelings drop all over the place. To solve this problem, he fashioned a curved scalpel out of a spoon, attached it to what had been the handle of an old buttonhook, and then fixed a straight steel blade to the other end of the tool. With this instrument, Ouellette is happy to report, orange peels come off in a jiffy, with no mess.

Paul J. Ouellette with his novel orange peeler, made from a spoon, a buttonhook, and an old knife



Braille Globe Aids the Blind

TO AID blind persons in following the news events in Europe and other corners of the world, a special Braille globe map has recently been developed. Small pins on the boundary lines of various nations project above the surface of the globe to enable a sightless person to trace the outline of a particular country with his finger tips, and thus judge its geographical size, position, and relation to the territory of other nations. Larger globe projections than those used for national boundaries outline the continents.



Pins stuck into the globe surface define the boundary lines



Basket Under Car Heater Is Stove for Baby's Food

WARMING the baby's food when on long automobile trips proves to be no problem for Thomas F. Spackman, of River Grove, Ill. Spackman attaches a wire basket below the heater underneath the dashboard of his car. When mealtime comes around, the heater is turned on, and hot air warms the baby's milk bottle and other food placed in the basket, as shown in the photograph below.



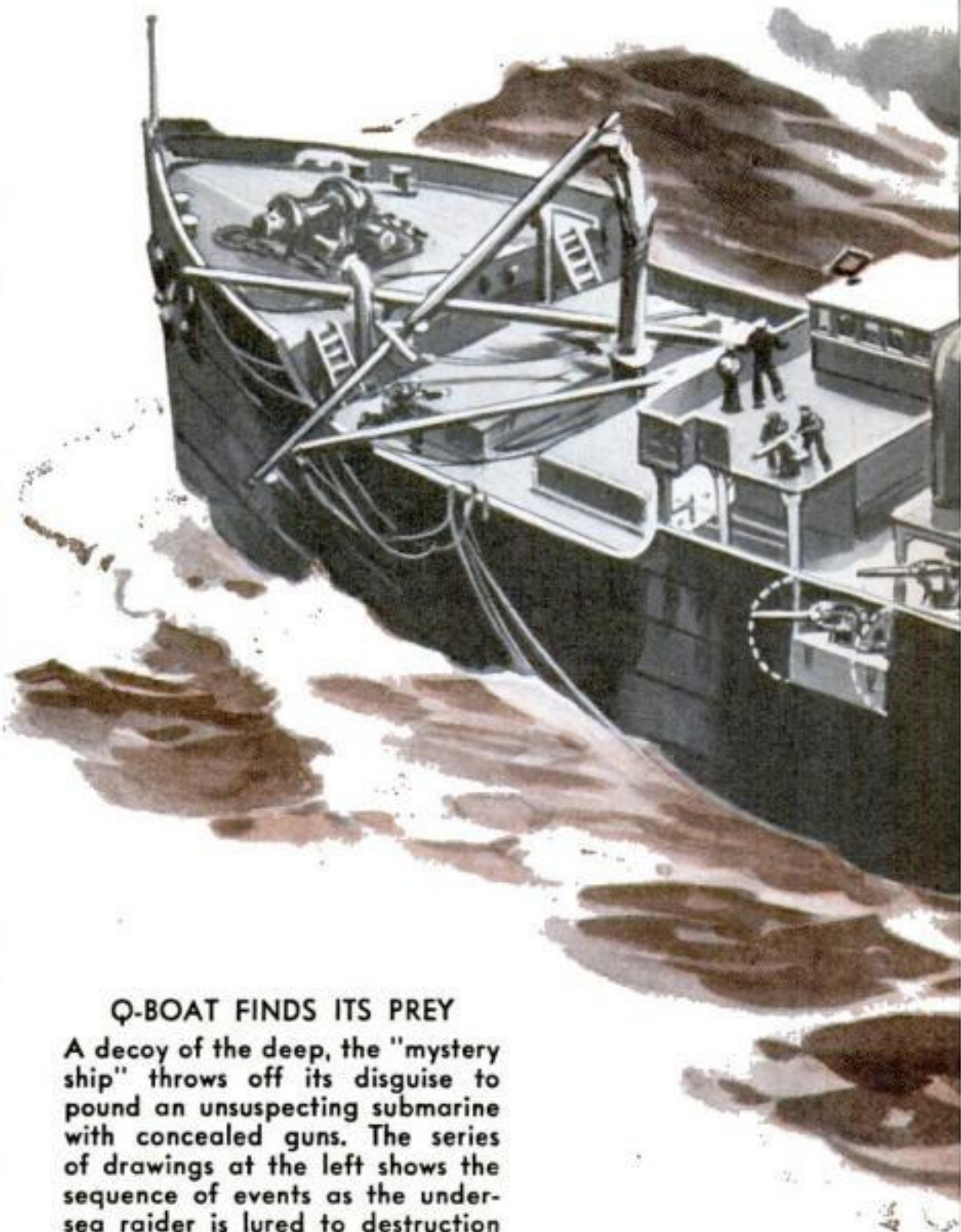
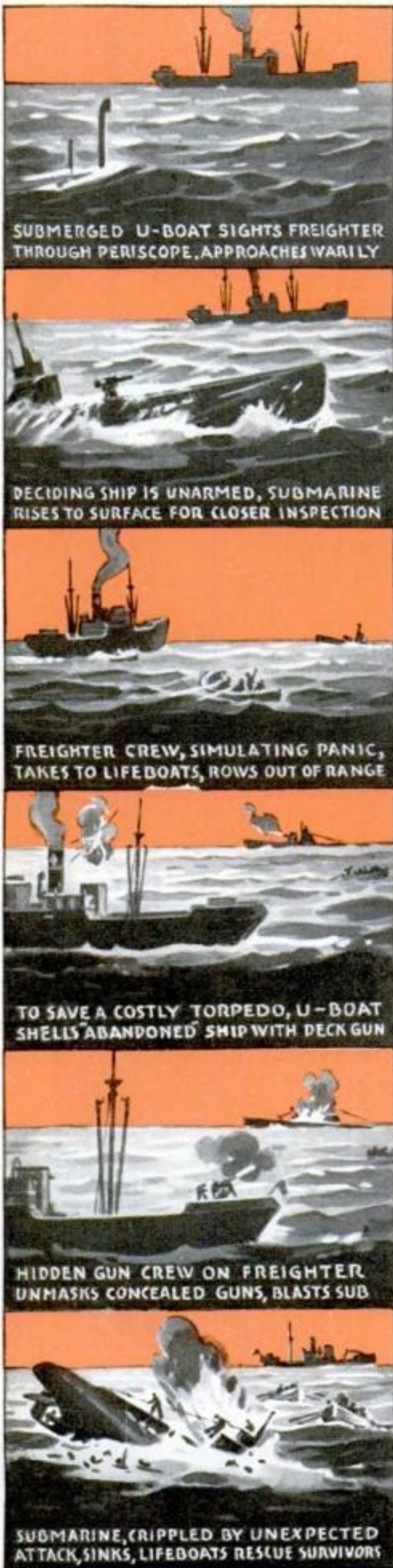
Hot air from the car heater warms the baby's meal

Waterfall Washes the Air in Paint-Spray Booth

EXCESS paint spray is trapped by a cascading wall of water in a novel system installed recently in an Endicott, N.Y., metal-finishing plant to protect workers and reduce fire hazards. Operating his spray gun, the painter faces a wall down which flows a curtain of water at the rate of twenty-two gallons a minute. Air in the paint booth is drawn through the water by electric fans mounted near the base of the wall. Thus the water, which contains a special washing compound, traps the excess paint spray, making the air in the paint booth completely safe for workmen to breathe and eliminating the need of face masks.

Q-BOATS...

TO MAINTAIN her vaunted position as mistress of the seas, will Britain revive her famed World War "mystery ships" for battling the menace of German submarines? Officially named Q-boats, these vessels were tramp steamers, colliers, small oil tankers, and other ships fitted with hidden guns and manned by Royal Navy crews dressed as merchant sailors. Many an unsuspecting U-boat was lured to its doom by the planned, rehearsed tactics of these innocent-looking sub hunters. Apparently as defenseless as a wooden duck decoy, a weather-beaten tramp steamer would plod through the submarine-infested waters of the north Atlantic Ocean. Sighting it through his periscope eyepiece, the German commander of a cruising U-boat decides to save a costly torpedo by sinking the "unarmed" cargo-laden ship by shell fire from the submarine's deck gun. As his craft breaks the surface, the cap-

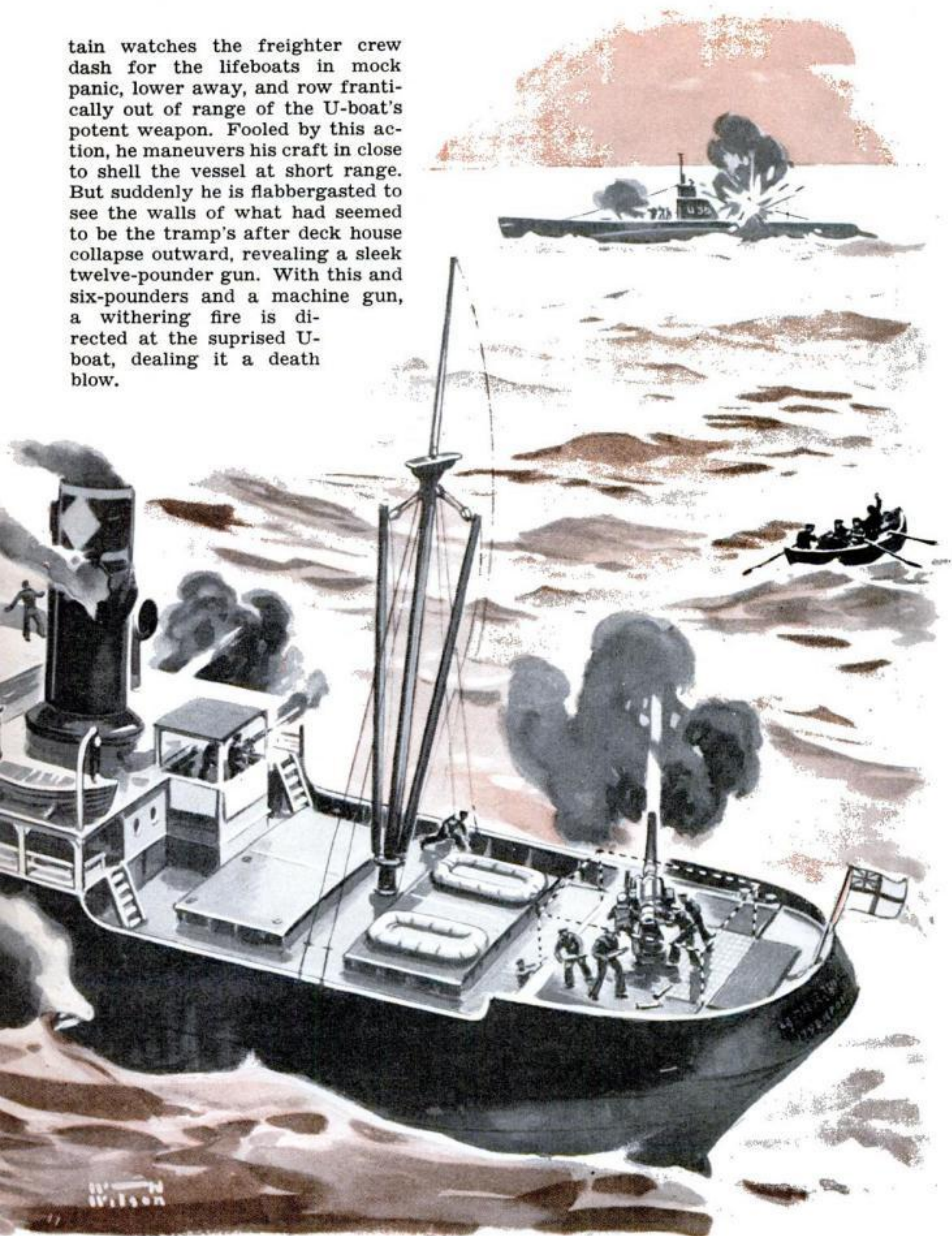


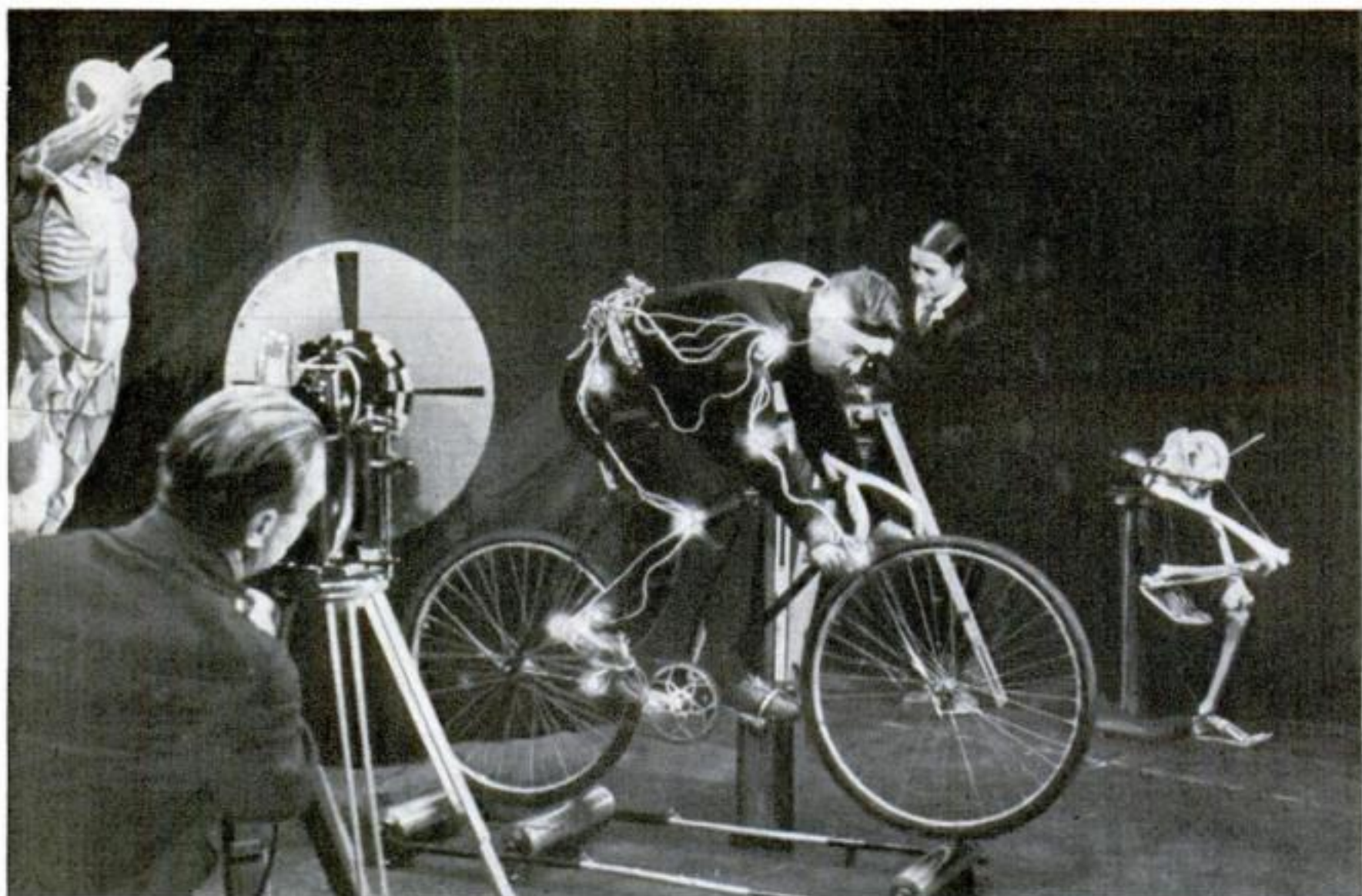
Q-BOAT FINDS ITS PREY

A decoy of the deep, the "mystery ship" throws off its disguise to pound an unsuspecting submarine with concealed guns. The series of drawings at the left shows the sequence of events as the under-sea raider is lured to destruction

An Answer to Submarines

tain watches the freighter crew dash for the lifeboats in mock panic, lower away, and row frantically out of range of the U-boat's potent weapon. Fooled by this action, he maneuvers his craft in close to shell the vessel at short range. But suddenly he is flabbergasted to see the walls of what had seemed to be the tramp's after deck house collapse outward, revealing a sleek twelve-pounder gun. With this and six-pounders and a machine gun, a withering fire is directed at the surprised U-boat, dealing it a death blow.





Tiny Lights Trace Cyclist's Movements

IN A darkened laboratory at the Lenin-grad Institute of Physical Culture, Russian athletes looking like ghostly skeletons pedal stationary bicycles while experts operate special photographic equipment to film the movement of tiny lights strapped to the

rider's legs, arms, and other parts of the body. When developed, the films indicate the exact path taken by the shoulder, elbows, hips, knees, and ankles of the cyclist in action. These records are then charted and used in physical-culture studies.

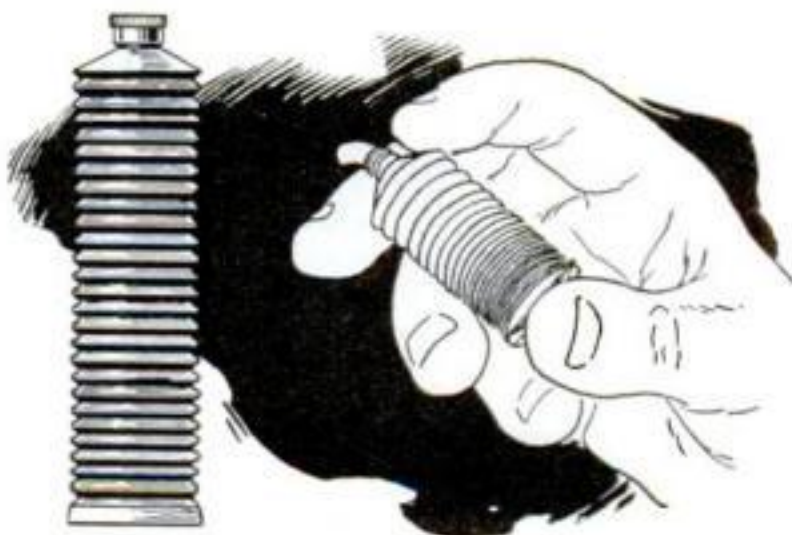


Rubber Strap Helps Skiers Keep Boots Flat on Skis

AN INSTEP STRAP of strong flexible rubber, just introduced, is designed to aid skiers in keeping the heels of their boots down flat against their skis in the correct position for most ski running and turns. As shown in the photograph above, the ends of the strap are fitted with metal arms that fasten into an adjustable clamp attached to the ski behind the ski harness.

Accordionlike Tube for Tooth Paste

MADE like the bellows of an accordion, a metal tube for tooth paste, shaving cream, or the like is fitted with horizontal, circular plaits. Its French inventor claims that the design makes it easier to squeeze out the contents by pressing it as shown below.



Pressure on the bottom forces out the paste

Four-Ounce Gas-Raid Outfit Designed for British Women

STYLE is the last and not the first factor considered in an odd outfit for British women recently placed on sale in London. The costume, made of lightweight oiled silk in various colors, consists of a jacket, hood, mittens, and knee-length pants, all guaranteed to repel poison gas. Worn with a gas mask and rubber boots, the four-ounce costume can be donned in thirty-five seconds, it is said. The outfit folds into a small carrying bag.

Every Letter Is a Puzzle on New Jig-Saw Stationery

RECOMMENDED only for correspondents known to have a keen sense of humor, novel note paper now available is made in jig-saw-puzzle form so that after the writer pens his message in the ordinary manner, he can break up the ready-cut stationery into tiny "jig-sawed" pieces. These are then mixed thoroughly, dumped into an envelope, and mailed. The dazed recipient must put the pieces together to read the letter.



After a letter is written, the paper separates into a jig-saw puzzle



Worn with rubber boots and gas mask, the light suit gives perfect gas protection



The lamp folds against the keyboard so that the desk may be closed

Folding Lamp for Typewriters

FURNISHING shadowless illumination without glare, a lighting unit just placed on the market is designed specially for use with typewriter desks. Fitted with an adjustable shade, the lamp is held in position above the typewriter by means of a long metal arm attached to the back of the machine. When not in use, the unit may be folded down over the keyboard so that the desk may be closed.



Dr. A. P. Ousdal using a portable tripod to lift a large fossil specimen for loading in his special trailer. Above, the California physician is seen in a corner of his unique "rock library" of relics of prehistoric ages

AMATEUR COLLECTS 500,000 FOSSILS

CHIPPING away patiently at a giant slab of sandstone, scientists at the University of California at Los Angeles are uncovering what may prove to be an archeological "find" of immense importance. Embedded in the rock, which far antedates the known beginnings of human life on this planet, is an object that appears to be an ancient vase. On the exposed edge of the vase are markings that may be an inscription in an unknown language.

Credit for the discovery of this interesting object goes to Dr. A. P. Ousdal, Santa Barbara

In Walks Near His Own Home, Dr. A. P. Ousdal Has Gathered an Amazing "Library in Rock" Showing Secrets of the Past

By
ANDREW R. BOONE

physician and amateur paleontologist. Nearly every week-end for twenty years, Dr. Ousdal has waded in the Pacific Ocean or climbed mountains fringing the deserts of the Southwest. Painstakingly he has lifted from the earth and the sea fossils ranging in size from a thimble to an office desk. In his "library of rock" are more than a half million relics of the past.

His collection of storied rocks and fossils has spread his fame around the world. On and within these ancient volumes are being read stories of ancient life hitherto unknown.

Scores of whale skulls and bones, mastodon teeth dug within his home city, sedimentary algæ-bearing rock, prehistoric sea cows, and parts of many monsters unknown today fill his museum. Like a dog burying bones, Dr. Ousdal has secreted deep under the sand at a dozen points along the southern California coast many specimens dragged from the sea for future study.

He has turned up many amazing finds during his two decades of roving research. As he subjected thousands of specimens to scrutiny, he became convinced that somehow, somewhere among these fragments of the past he would find some definite link between life of the twentieth century and life many millions of years before the Christian era, long before recorded history began to pick up the story of evolution.

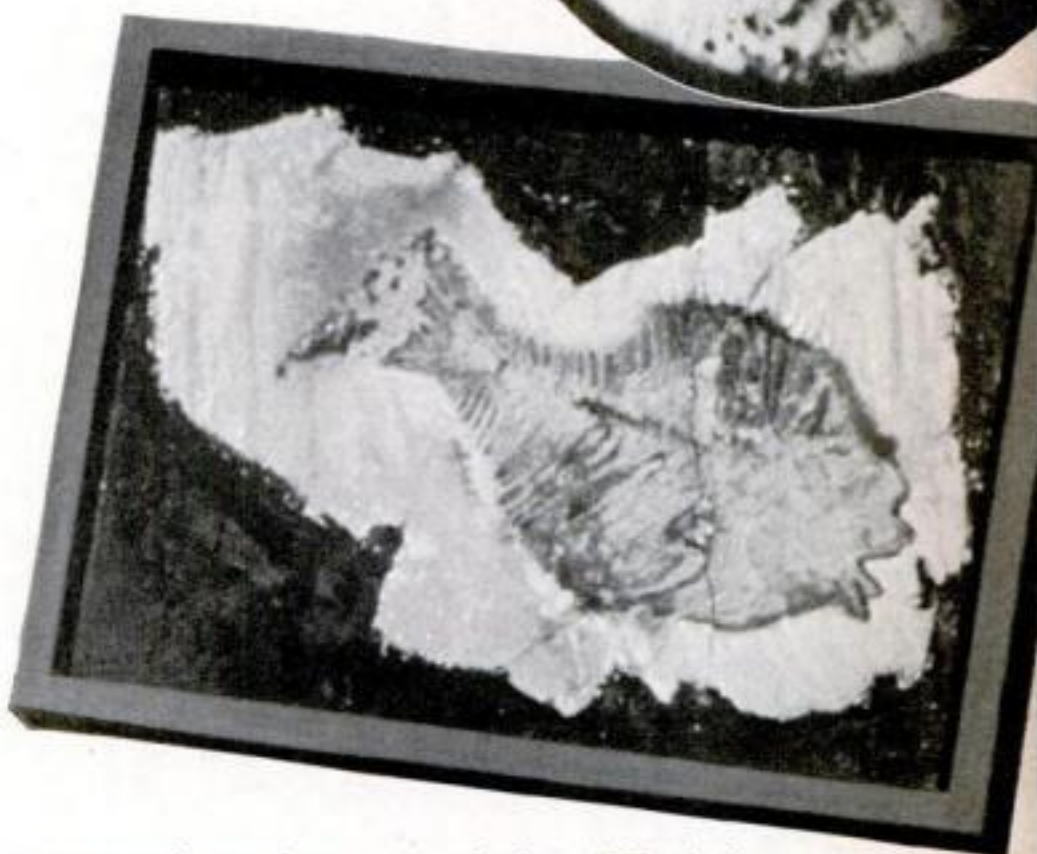
"If only I could focus a microscope on these rocks and fossils," he told me recently, "I felt I could uncover some really startling facts." Nights, week-ends, holidays he searched for a way. Gradually, he evolved a secret chemical method for softening rock. Slowly, he became able to slice very thin sections from softened rock and petrified wood. He stained these samples, laid them carefully on glass slides. He looked through them, made photographs which enlarged tiny sections 1,200 times.

One of these combined a section of fossilized wood and bone from an antediluvian

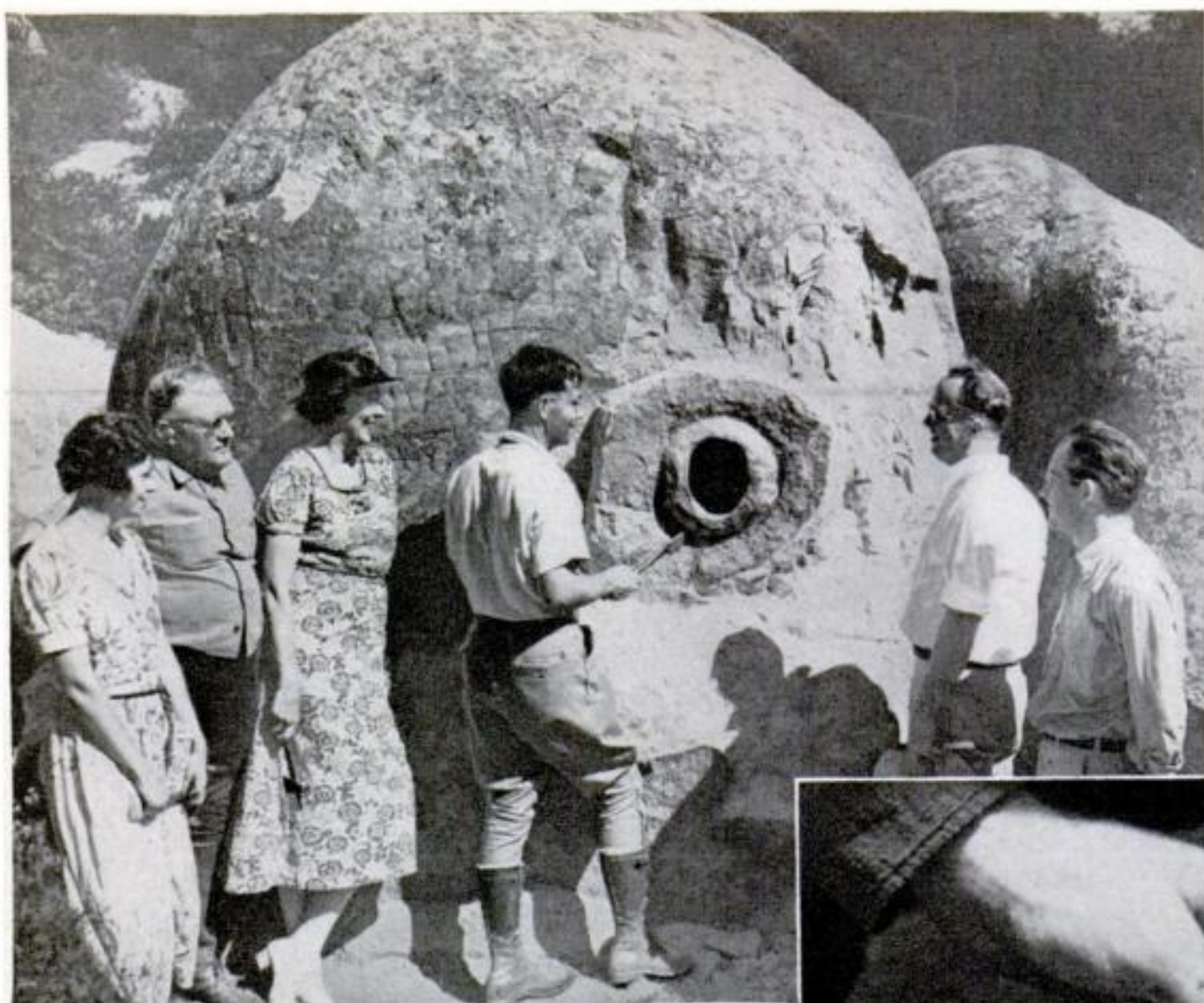


The amateur paleontologist removes a barnacle from the rib of a petrified mammal, perhaps a whale or a sea cow

Right, photomicrograph of bacteria that lived 80,000,000 years ago. The fossil fish below is 35,000,000 years old



mammal, perhaps a whale. What he saw amazed him. He could scarcely believe his own eyes. Again, he sliced away part of the fossilized rib of a fish embedded in stone. Another time, he removed the hole and



IS THIS A RELIC OF PREHISTORIC MAN?

In the San Marcos Pass, near Santa Barbara, Calif., Dr. Ousdal discovered this strange object, which appears to be an ancient vase embedded in stone that is older than the known beginnings of man on the earth. On its rim is an inscription in an unknown language



capsule formed by wood pulp and termite excretions in a piece of fossilized wood. In all these samples, some found in geologic formations that date them back 60,000,000 years, he discovered the same things—fossil bacteria! Cocci, bacilli, and other germ forms well known today. In exactly the same forms as the 1939 models.

Has life changed in 600,000 centuries? "Not according to pictures of these bacteria," declared Dr. Ousdal. "Their structures are the same. Such changes as we know are largely the results of environment." But the doctor, not content to look back only upon this brief period in the world's history, searched farther afield. One day while walking in the mountains

near Bakersfield, he came upon a piece of petrified Oregon pine. Geology told him this rare find was some 80,000,000 years old. Suspecting he had made a spectacular discovery, he hurried back to his laboratory, and there trained his microscope upon a transparent slice of the fossil.

The microscope enlarged the muscular structure, and showed him he was looking through the wall of a beetle's intestine. Photographs reveal the petrified bacteria, as small dots in definite colonies.

Dr. Ousdal, a native of Flekkefjord, Norway, thanks his love of walking for interesting him in paleontology as a hobby. Shortly after moving to Santa Barbara he and Mrs. Ousdal began to take daily hikes

on the near-by beach. He was attracted by the unusual formations and odd specimens washed up by the waves. His early finds were parts of petrified whales, and before long he discovered mastodon teeth older than any unearthed in the Brea pits at Los Angeles.

Although he roams far afield, sometimes 300 miles distant into the mountains and deserts along the California-Nevada border, his principal hunting grounds extend only two miles along the beach, where fossils may be seen easily under the water at low tide. From this stretch and near-by he has uncovered more than fifty tons of petrified materials, some pieces weighing thousands of pounds. The history these cover staggers the imagination, representing as they do the rise and fall of continents, the birth of new lands and the voracious appetite of the sea in swallowing them anew. No less than a dozen whale skulls dot the exhibit. One of his rare discoveries is a complete spinal column, unbroken from the lumbar to the small end vertebra, exhumed

by him from out of the side of a mountain.

Dr. Ousdal often works by the light of the moon, especially when near inhabited areas, where people might think him "queer," or officers of the law might take steps to halt his work. To ease his labors, he has developed a special trailer, tripod, and winch with which to drag heavy pieces from their resting places and lift them into the vehicle. He calls the outfit his "fossil wagon."

His is truly a hobby, in that he derives no money profit from his labors. But he has a definite philanthropic aim. He hopes to bring about the establishment of an aquarium in which live fishes and marine plant life would thrive alongside the fossils, which would illustrate the life that preceded the present stage in nature's evolution. "Only by comparing the present with the past can we learn the significance of the past," he declared. His collection would be his offering to such an undertaking, a biological institution such as has never been opened to students of life.



Here Dr. Ousdal is comparing an elephant tooth, which he obtained from Alaska, with a set of mastodon teeth which he himself discovered while working at midnight within his home city. At the right he displays the skull and a false rib from a prehistoric whale's remains



Barrel Pusher Is Time Saver

TIME and labor are saved in moving barrels and large drums by a novel pushing device just placed on the market. Four caster wheels are mounted on a framework fastened to a long handle, as shown in the illustration above. By manipulating the handle, a workman finds it easy to push loaded barrels along the floor, and to steer the rolling drums by exerting pressure toward one side or the other. The device weighs only six pounds and is extremely easy to use.

Pocket-Size Sander Renews Worn Reeds of Wind Instruments

MUSICIANS who play wind instruments employing reeds should welcome an economical reed-sanding device now available. Instead of being discarded after long usage, the reed may be sanded down and reshaped to give it new life. The reed is first placed on the polished metal plate of the unit, and then stroked with an abrasive cloth wrapped around a flexible roller, as shown below.

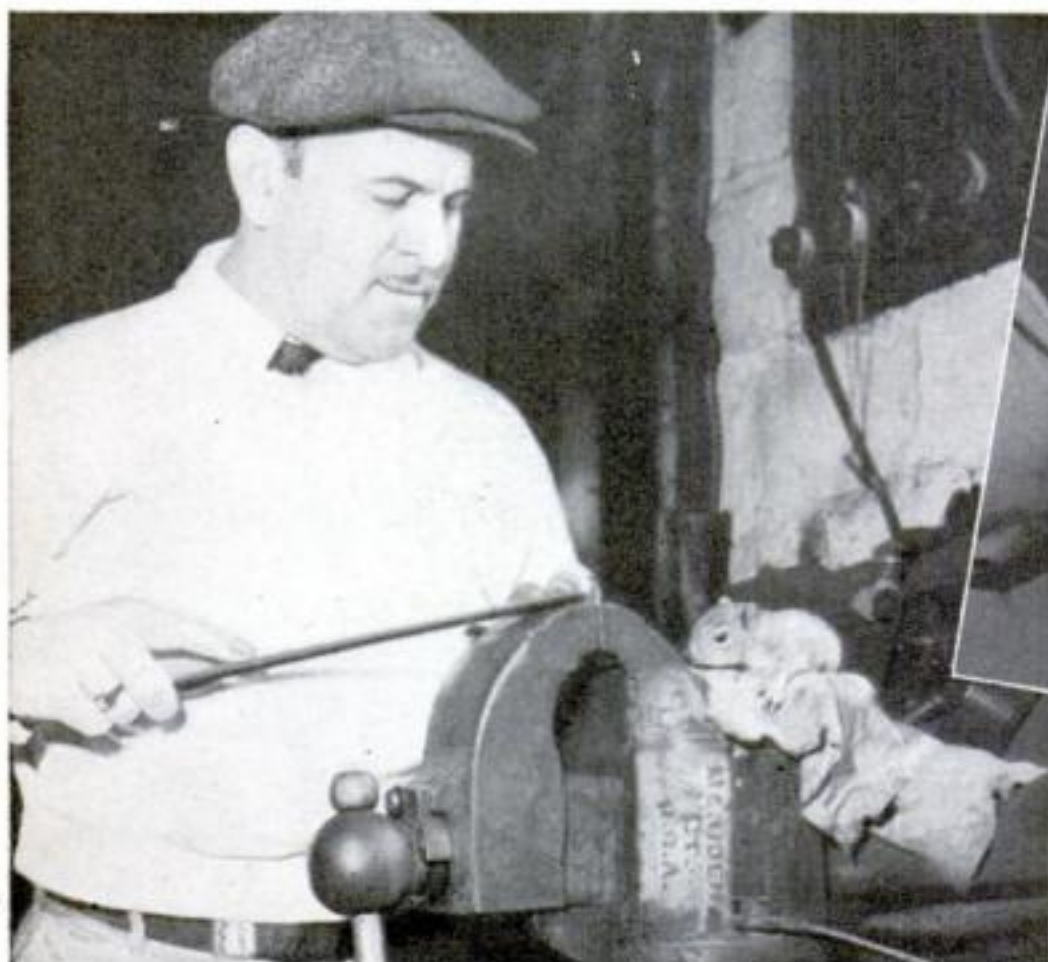


How a reed is renewed with the unit. The sander fits inside for carrying

Nuts (and Bolts) Lure Pet Squirrels

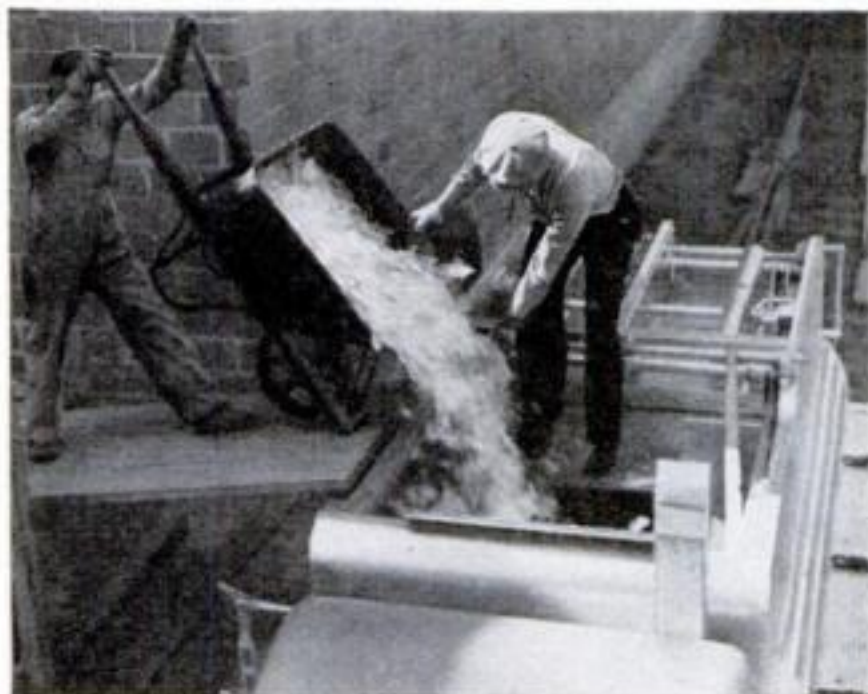
DESPITE the fact that all the nuts lying around are crackproof, a family of baby squirrels has adopted the automobile repair shop of Eddie Power in Great Neck, N. Y.,

as a home. Domiciled in a cardboard box, the tiny rodents scamper around the workbenches and tools with the greatest contentment as Power goes about his work.

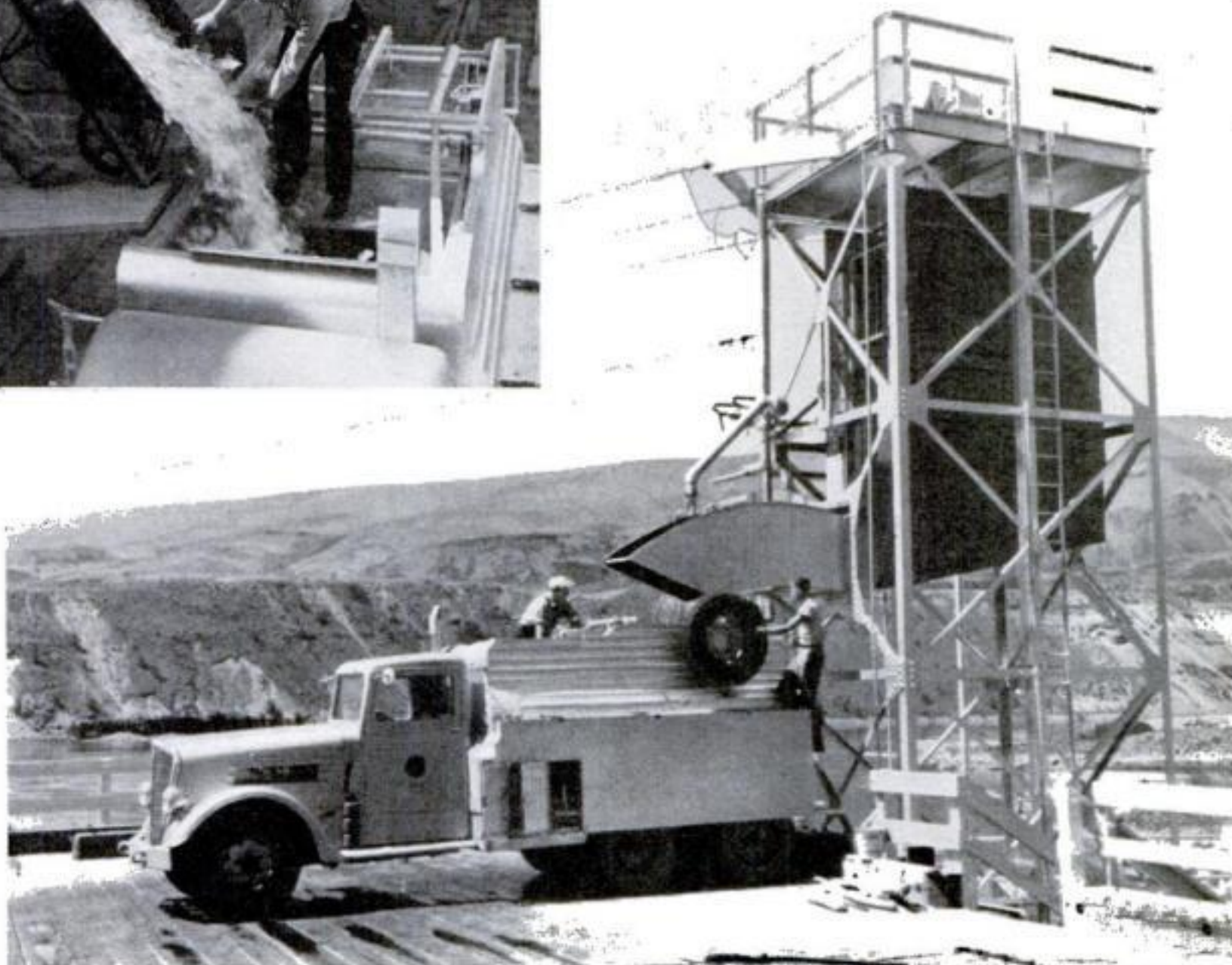


Undaunted by inability to crack the nuts they pick up in Eddie Power's auto repair shop, the squirrel family shown above stays perfectly happy

Fish Ride Elevators and Trucks



Loading Columbia River salmon into a truck that will take them to spawning streams. Inset shows truck being iced to chill water



UNABLE to climb through the tumbling waters that cascade over Grand Coulee Dam on the Columbia River in Washington, tens of thousands of salmon heading upstream to spawn are being lifted in electrically operated elevators, transferred to ice-chilled trucks, and released in four near-by streams. The elevators have been installed at Rock Island Dam, 100 miles downstream from Grand Coulee. Here, migrating fish are trapped and dumped from elevators into specially constructed trucks. To reduce the temperature of the Columbia River water to the temperature of the Wenatchee, Entiat, Methow, and Okanogan rivers in which they are ultimately placed, from 800 to 1,200 pounds of crushed ice is carried in each truck. Chinook and steelhead salmon are placed in all four rivers, while bluebacks are planted only in the Wenatchee



At their destination, fish are dumped into a tributary stream

and the Okanogan, because this variety frequents only the streams that have lakes in their courses. Barriers in the rivers and their tributaries confine the fish to certain streams in whose headwaters they spawn.

Handy Helps



CHEESE CONTAINER

Cheese is said to be kept fresh indefinitely in the glass container below. Its bottom has raised projections on which the cheese rests, with a mixture of vinegar and salt below it



PLATE HOLDS GLASS. For serving lap luncheons and suppers, these novel plates hold glasses or cups and can be stacked



CABINET KITCHEN. The cabinet above houses a complete kitchen, including electric stove, refrigerator, sink, and storage space, as at right



for Homemakers



CAKEPROOF SALT SHAKER. Salt always comes freely from the cone-shaped opening of this new shaker, part of a pepper-and-salt set



SYNTHETIC-RUBBER MITTENS protect the housewife's hands while cleaning silver and performing other tasks. They resist acid and alkali



CLEANING GLASS COFFEE MAKERS is simplified by the brushes at left, with a handle that gives them a rotary motion



KITCHEN COMBINATION. A mixer, food chopper, fruit juicer, and potato ricer are combined in the versatile kitchen tool shown above and at right. The various units are easily attached to a stand on a base with rubber feet



Police Cycles Get Powerful Loudspeakers

The policeman talks into a microphone connected through an amplifier to a speaker over the front wheel



TO SOUND alarms during wartime air raids, and direct pedestrians to the nearest underground shelter, British officials have installed public-address systems on police motor cycles in London. The loudspeaker is mounted in the normal headlight position, while amplifier and batteries straddle the rear wheel.

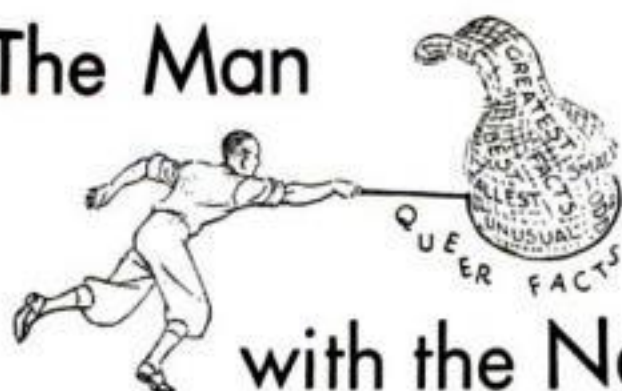
Clamps Make Tire Chains Go On Easy

STRUGGLING to put chains on the tires of an automobile is a thing of the past, according to the makers of a chain clamp just marketed. Made of spring steel, the clamp is clipped snugly onto the tire, and the chain fastened to hooks on the side of the clamp. Then the car is driven forward until the wheels have made one complete revolution, and the chains are in position for permanent fastening.



Hooked on the clamps, the chains circle the wheels as the car moves ahead

The Man



with the Net

NEW YORK CITY has 2,000 families that receive their mail by Rural Free Delivery.

OCEAN SUNFISH between birth and maturity, increase their weight as much as 60,000,000 times.

DOGS are able to digest bones because their stomachs secrete hydrochloric acid.

TICKS are not insects.

NOW, THEY ARE

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ONLY TEN of the seventy-eight principal farm-crop plants in America are native to the country.

STRATOSPHERE balloons rise about fifteen additional feet for every pound that can be saved during construction.

ARGENTINA specifies the exact tone for all automobile horns.

BABY WHALES weigh about seven tons at birth.

WHEE, A
7-TON BOY!



SEVENTY rows of telephone poles, each supporting sixty wires, would be needed to carry all the wires contained in one modern cable less than three inches thick.

JACKS for children are now made of bright-colored plastics.

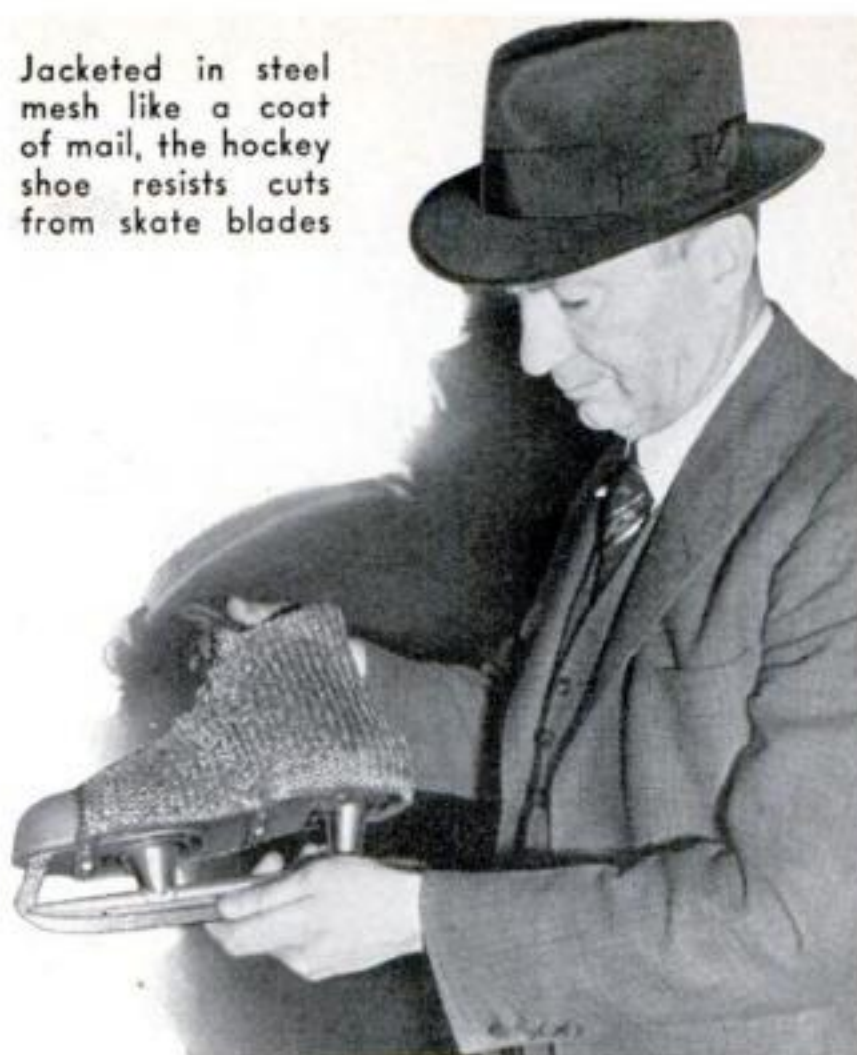
CARRIER PIGEONS brought first official word to Rome of Caesar's conquest of Gaul.

ANACONDAS, eighteen feet long, sometimes give birth to as many as seventy-three baby snakes, having a combined length of more than 200 feet.



YET THEY MAKE A
FUSS ABOUT THE
QUINTS!

Jacketed in steel mesh like a coat of mail, the hockey shoe resists cuts from skate blades

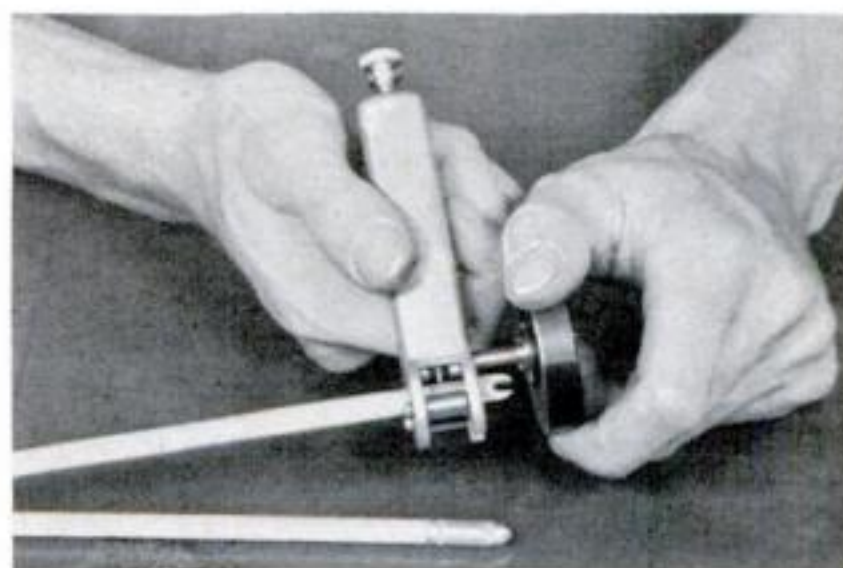


Slashproof Hockey Shoes

TO PROTECT the feet and ankles of ice-hockey players from injury by the slashing skate blades of other players, a new type of skate shoe has been devised. Except for the toe portion, the exterior of the shoe is completely covered with a tough protective layer of strong steel mesh.

Archers' Crimping Tool Applies Arrow Tips

METAL tips and "nocks" for fitting arrows to bow strings are easy to crimp on arrow shafts with a novel archers' accessory just marketed. When the nock or tip is slipped on over the arrow shaft, the latter is placed in the hand machine as shown below. Turning a wheel then crimps the nock or tip permanently to the wood.



Crimping on an arrow nock with the handy unit



After the polarizing filter is adjusted by eye, it is swung sideways and down over the camera lens

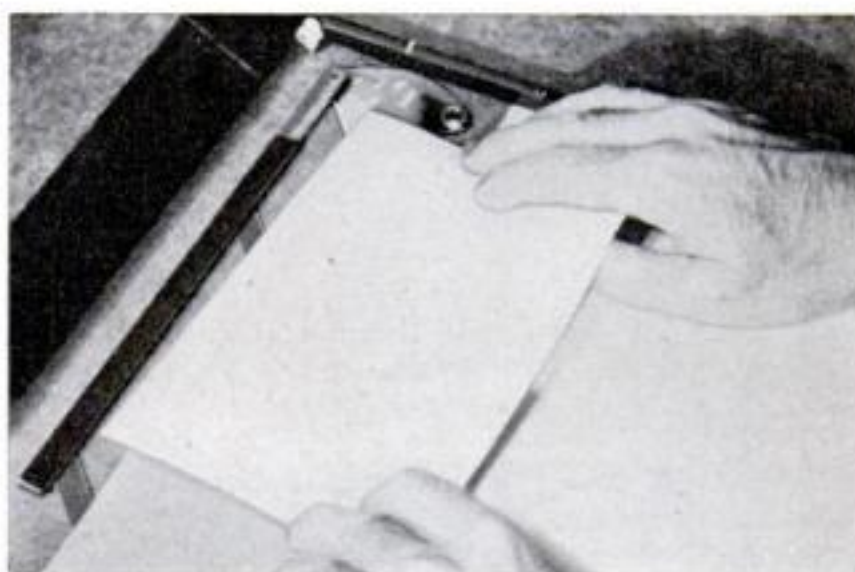
LATEST

Direct-View Polarizer Swings Down over Lens

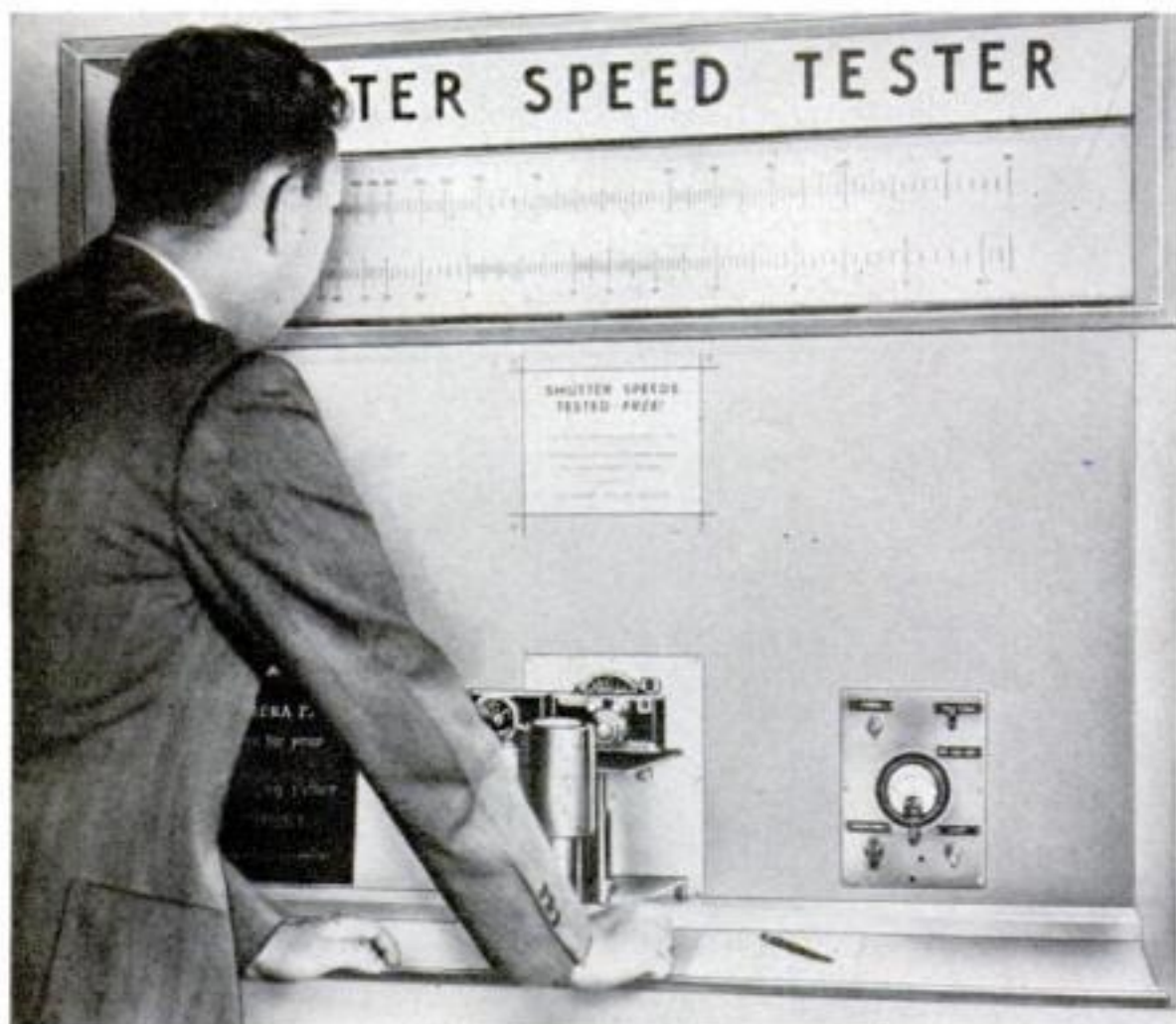
TO SAVE time in adjusting a polarizing filter to the right angle for cutting down glare, a figure-8-shape filter holder, pivoted at its center, has been developed for miniature-camera use. The upper half holds the filter in a convenient position for viewing the scene to be photographed, and the lower half fits over the lens. By rotating the filter, the proper setting is determined. The upper half is then pivoted sideways through a 180-degree arc into position over the lens, where its filtering powers are identical with those of the original sighting position.

Novel Enlarging Easel Assures Even Margins

EVEN margins on enlargements made on a new easel are assured by the action of a mechanical guide that sets the position of the edges of the paper when a handy button is moved. After setting the paper by means of the device, the user then lowers two hinged margin arms over the paper, and moves them into place according to the position indicated by a white marker on the black metal strips, to give the desired width to the margins.



The paper is first set flush against a guide bar



The speed of a camera's shutter is indicated on the large scale

Automatic Device Tests Accuracy of Camera Shutters

CAMERA owners visiting a recent photographic exhibit were given an opportunity to check the accuracy of the speed settings of their camera shutters with the unusual tester shown at the left. Placing a camera in an opening in the device and flicking the shutter at a given speed gives an immediate check-up on the shutter's condition. Measuring exposure speeds between a twenty-fifth and one two thousandth of a second, the apparatus discloses any shutter inaccuracies.

PHOTOGRAPHY AIDS



Soaked in developer before the projection is made, the paper develops under the enlarger

New Chemical Lets You See Enlargements Developing

PERMITTING control of density in enlargements, a new developer lets the photographer watch the image develop under his enlarger. Furnished in powder form, the developer is mixed with water, and the sensitized paper is soaked in it for thirty seconds. At any time during projection, development may be examined under a safe light.

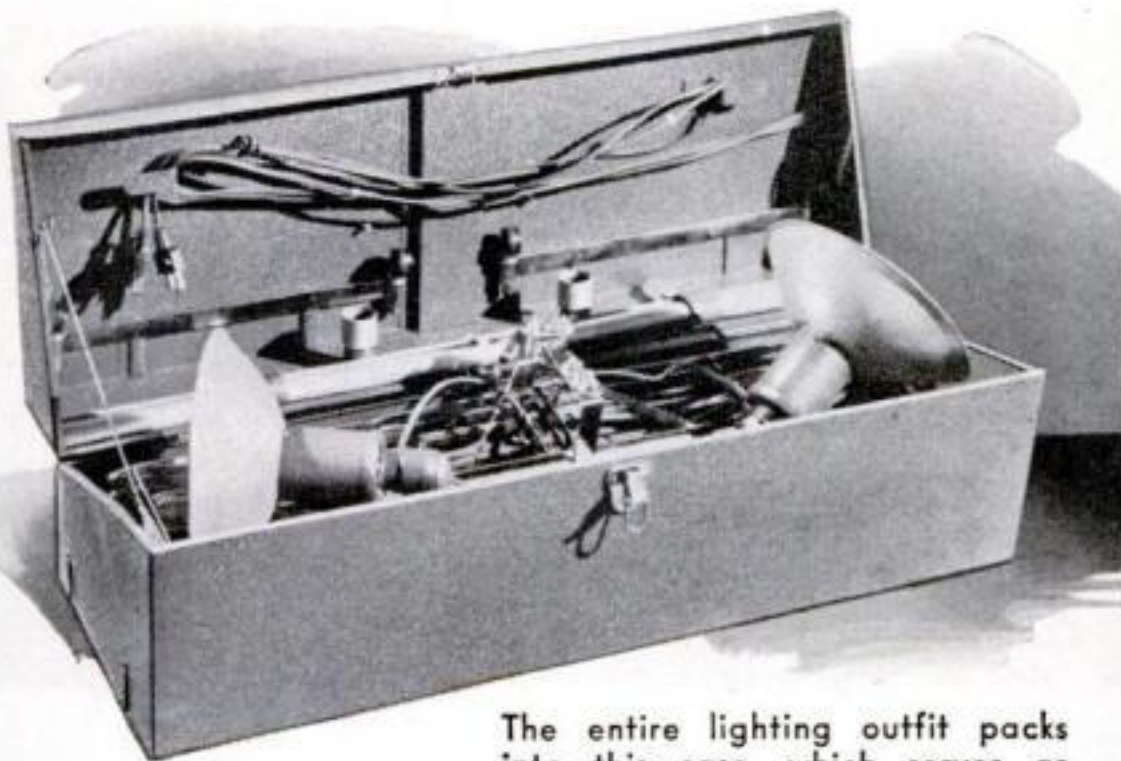
Preset Exposure Meter



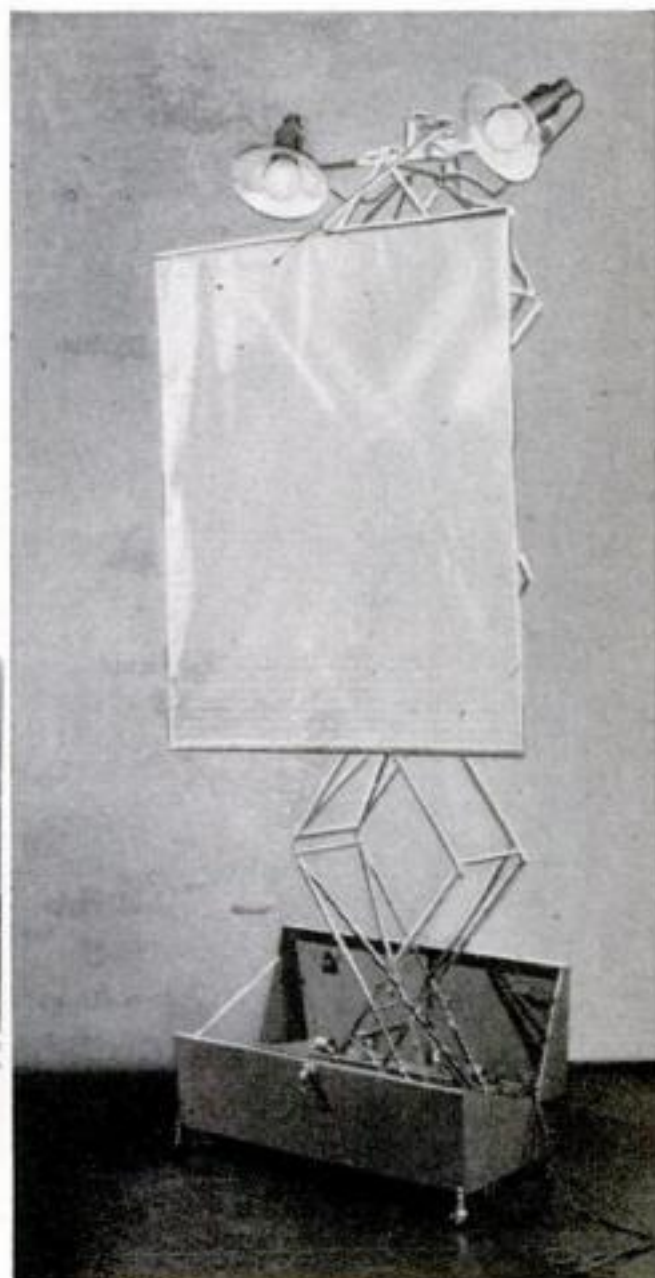
SETTING a dial on a new photo-electric exposure meter to any given combination of film-emulsion and shutter speeds—if used with a movie camera, film speed and frames to the second—gives a direct reading on its dial of the proper aperture for snapping a scene at which the meter is aimed.

Lighting Outfit Is Portable

UNFOLDING to a maximum height of ninety-four inches, a photographic lighting unit just developed consists of a pantographlike standard that supports two reflector and lamp units and a light-diffusing screen at its top. The device stands upon a caster-equipped case when in use. The entire assembly folds up into the case for carrying.



The entire lighting outfit packs into this case, which serves as a base when lights are extended



POPULAR SCIENCE Question Bee

If you get eighteen out of the twenty posers right, pat yourself on the back. If you get nineteen, ask the boss for a raise. Answers on page 235



1 Archimedes declared he could move the earth if he had (a) the power to divert the Gulf Stream (b) a pendulum with a length of 3.1416 stadia (c) a daily diet of spinach (d) a fulcrum on which to place a lever.

2 "Mansard" is the name given to a kind of (a) pavement (b) roof (c) automatic loom (d) flask used by chemists (e) bridge truss.

3 The metatarsal arch is a part of (a) a Gothic-style doorway (b) a suspension bridge (c) your foot (d) a rainbow.

4 To an Army man, "ordnance" means things like (a) corned beef and cabbage (b) artillery and shells (c) strategic supplies of rubber, tin, and chromium.

5 A light year is (a) a year of minimum sun-spot activity (b) the distance that light travels in one year (c) any year except leap year.

6 All gases are highly (a) inflammable (b) compressible (c) active chemically (d) concentrated fifty miles above the earth.

7 A liter (pronounce it "leeter") is slightly more than a (a) bushel (b) ton (c) fathom (d) quart (e) yard.

8 The South Pole was discovered by (a) Peary (b) Byrd (c) Amundsen (d) Shackleton (e) Scott.

9 Nonferrous metals (a) never rust or corrode (b) do not expand or contract appreciably with temperature changes (c)

contain no iron (d) will not conduct an electric current.

10 A famous and beautiful temple of ancient Greece was the (a) Louvre (b) Colosseum (c) Kremlin (d) Parthenon.

11 An estuary is (a) the wide mouth of a tidal river (b) a rider on horseback (c) a large bird of prey (d) a man who calculates insurance risks and premiums.

12 Atmospheric pressure is greatest (a) on a mountain top (b) in a deep mine (c) at sea level.

13 Your pituitary gland is in your (a) stomach (b) head (c) throat (d) liver.

14 An induction coil is a kind of (a) water heater (b) electrical transformer (c) condenser for stills (d) watch spring.

15 The radiator of an automobile should be kept filled with (a) gasoline (b) oil (c) water (d) compressed air.

16 In case the Panama Canal were put out of commission, ships would have to travel around (a) Cape Hatteras (b) Cape Horn (c) the Cape of Good Hope.

17 As you travel away from the equator and toward the pole, a degree of longitude becomes (a) longer (b) shorter (c) thicker (d) wider.

18 You see no stars at noon because (a) they have moved to the other side of the earth (b) clouds are in the way (c) reflected sunlight from the sky outshines them.

19 A motorist gets more miles to the gallon in Canada than in the United States, because (a) engines run more efficiently in Canadian air (b) the roads are smoother (c) the British gallon is bigger than ours.

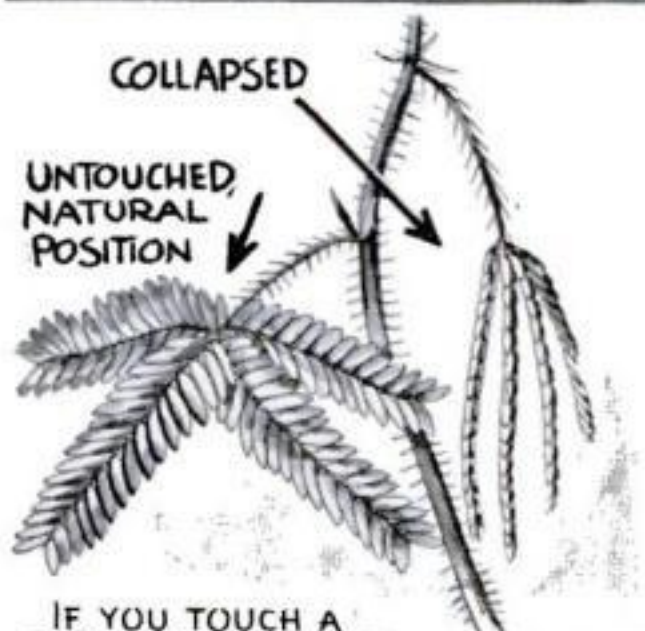
20 A well-dressed citizen of ancient Rome wore a (a) shako (b) cummerbund (c) parka (d) fez (e) lei (f) toga (g) sarong.

Un-Natural History *By Gus Mager*

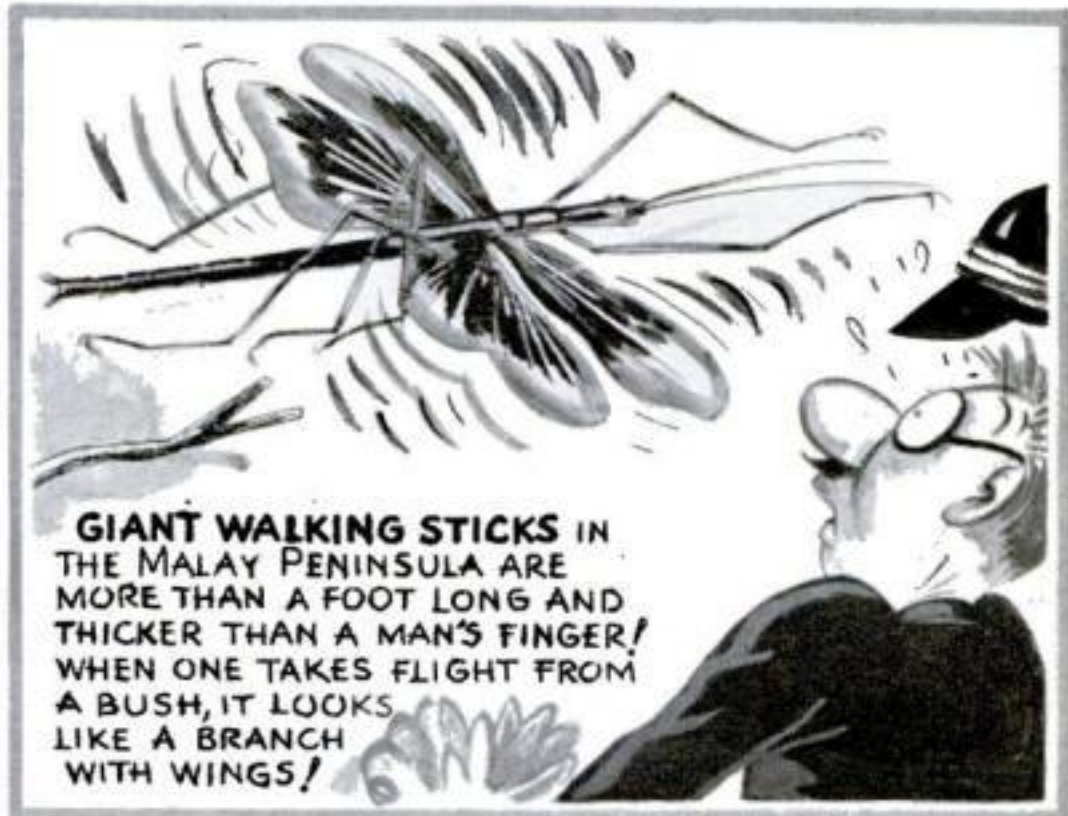


UGLIEST ANIMAL IN THE WORLD, THE AFRICAN **WART HOG** IS SO SUSPICIOUS THAT IT ALWAYS ENTERS ITS HOME BACKWARD!

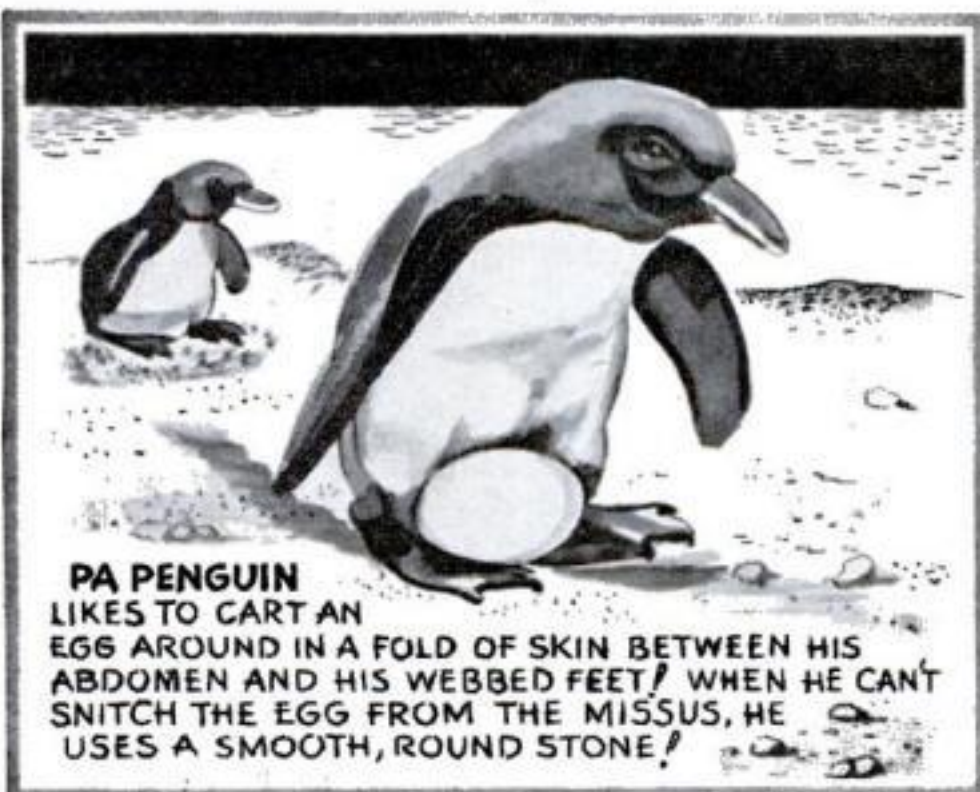
ROLL-WING CRICKETS, OF THE HIMALAYAS, ARE SAID TO ROLL UP THEIR WINGS LIKE WINDOW SHADES!



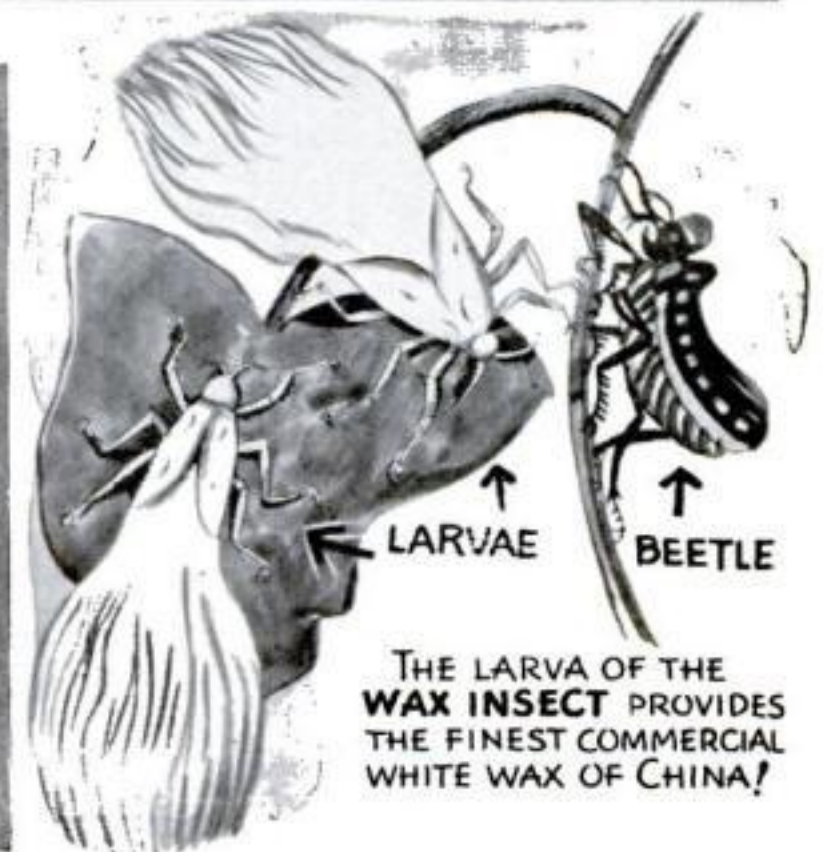
IF YOU TOUCH A **SENSITIVE PLANT**, IT COLLAPSES ITS LEAVES RAPIDLY IN THREE MOVEMENTS! FIRST THE LEAFLETS CLOSE IN PAIRS, THEN THE FOUR LEAF BRANCHES APPROACH EACH OTHER, AND THE MAIN LEAFSTALK BENDS DOWN!



GIANT WALKING STICKS IN THE MALAY PENINSULA ARE MORE THAN A FOOT LONG AND THICKER THAN A MAN'S FINGER! WHEN ONE TAKES FLIGHT FROM A BUSH, IT LOOKS LIKE A BRANCH WITH WINGS!



PA PENGUIN LIKES TO CART AN EGG AROUND IN A FOLD OF SKIN BETWEEN HIS ABDOMEN AND HIS WEBBED FEET! WHEN HE CAN'T SNITCH THE EGG FROM THE MISSUS, HE USES A SMOOTH, ROUND STONE!



THE LARVA OF THE **WAX INSECT** PROVIDES THE FINEST COMMERCIAL WHITE WAX OF CHINA!

He began playing the blowtorch flame over the muffler outlet pipe, and in a few seconds water was dripping out



. . . SAYS GUS WILSON

IT HAD come on cold during the night—the first real cold snap of the winter. So Gus Wilson and Joe Clark had come down to the Model Garage earlier than usual that morning. They knew that they had a busy day ahead of them.

"Yes," Gus agreed with his partner as he pulled on his overalls in the snug little office, "when winter comes a lot of automobile grief comes with it. Some of it is unavoidable, of course, but more of it isn't. Most drivers in this town are careless. Take cold-weather starting trouble, for example. I'd say that ninety percent of it is caused by the lack of a good hot spark. Well, to get a hot spark you've got to have a fully charged battery. Batteries are likely to run down quickly when it is cold—they don't function as efficiently as they do in warmer weather, and they have harder work to do. How many of our customers do you suppose pay any more attention to their batteries in winter than they do in summer?

Darn few of them! Most of them don't even bother to throw out the clutch when they step on the starter on a cold morning. They run their batteries down by making them turn over the transmission countershaft gears in the stiff, almost solid lubricant in the transmission case. They don't seem to realize that . . ."

"All right, all right!" Joe interrupted. "If people drove cars the way you think they should, we'd soon have to go out of business for lack of customers. Now, the way I look at it . . ."

Gus was grinning; it was his turn to interrupt. "Don't you hear that telephone ringing?" he demanded, and went into the shop. A little later he heard his partner telling Harry, the grease monkey, to take the wrecker and bring in a car.

Inside of fifteen minutes Harry was back with Dave Sledd's sedan in tow. Dave got out and grinned at Gus. "You like mysteries," he said, "so I've brought you one. Why

does this car run with four, five, six or seven spark plugs in, but go dead with all eight of them in? Figure it out. Quick now!"

"Sounds more like a riddle than a mystery," Gus said. "What's the big idea?"

Dave lit a cigarette. "Here's the sad story," he said. "This is the third winter I've had this car, and until last night I never had a bit of trouble getting it started. Yesterday evening I drove down to my married sister's with the old bus running swell, and parked in front of her house about half past eight. We got into a bridge game, and it was after twelve when I came out. By that time it had turned bitter cold. When I stepped on the starter the engine turned over a few times in a sluggish sort of way, and then quit.

"I kept on stepping on the starter, and the engine kept on starting and quitting, until I'd run down my battery. By that time Vic—he's my brother-in-law—had come out. He got his car and pushed me for a block. Same result. Then he pushed my car back to his garage.

"Vic is a good amateur mechanic, and he knows something about automobiles. His garage is heated enough to be comfortable, so we really went to work on my bus. We took the battery out of his car and put it in mine, and then we checked the wiring and the distributor and the gas line, but we couldn't find anything wrong.

"Finally we decided to check up on the spark plugs. When I had four of them out, Vic stepped on the starter, and the engine took off. It made a lot of racket, but it kept on running.

"We thought we had the trouble licked then; that it was caused by a defective spark plug. All the four I'd taken out looked O.K., but Vic had some new ones, so we put them in. But when I stepped on the starter the engine just turned over a couple of times, and then by golly it stopped again!

"Then we started experimenting. We tried the engine with five and six and seven plugs in, and it ran. But every time we put in the eighth plug, it would stop as soon as it got started.

"By that time it was after one o'clock, and we were feeling hungry, so we went in the kitchen to see what we could find in the refrigerator. My sister came down and made us some coffee, and I guess we were

in there for about half an hour. Vic said he wasn't going to need his car today, so I could have it. But before we put the battery back in his car, I gave mine one more kick—and it started right away and ran smooth as sirup!

"It was too late to do any more trouble shooting, so I put my battery in the back of my car to bring around to you for recharging, and drove home. When I got there I started to look things over again, but my garage isn't heated, and in a few minutes my fingers were all thumbs. I couldn't figure out what the dickens had been the matter, but so long as the engine was running again I decided to leave well enough alone, and went to bed.

"This morning I didn't think anything about the car until I stepped on the starter. Then the same thing happened—the engine turned over and then went dead. I tried it several times, but the same thing always happened. I didn't want to run Vic's battery down the way I had mine, so I gave you people a buzz on the phone. Now it's your headache."

Gus raised the hood and took out one of the spark plugs. "I doubt if this is what I'd call a headache," he said. "Step on her."

The engine started promptly and ran noisily. "I told you that it would do that," Dave said. "As soon as you put the plug back it will stop."

Gus walked around to the back of the car and stood there for a few seconds, then went over to his workbench and fired up a blowtorch. Then he replaced the plug, closed the hood, and went back to the rear end of the car.

Dave followed him. "What are you going to do?" he wanted to know.

"Get your engine running right for you, of course," Gus told him. He began playing the blowtorch flame over the muffler outlet pipe, and in a few seconds water began dripping from it. "Your only trouble is that water condensed from the exhaust fumes has collected in the muffler pipe and frozen. The pipe is plugged solid with ice. The exhaust can't get out, so of course it sets up a back pressure which kills the engine. Taking one of the plugs out leaves a hole through which the back pressure can escape, so your engine runs. Savvy?"

Water was trickling

It's an Ill Wind That Blows
Nobody Good, and Winter's
First Icy Blast Sends Ailing
Cars to Gus's Model Garage

By MARTIN BUNN



out of the pipe in a stream now. Gus got an old file from his bench, and worked it up into the pipe a few times. Then he picked several chunks of ice out.

Dave Sledd's face got red. "I'm a bone-head," he said bitterly. "Why, last night I had the explanation right under my eyes, but I was too dumb to dope it out."

Gus laughed. "You mean that you noticed a pool of water on the garage floor under the rear end of your car when you came out from that free-lunch session in your sister's kitchen," he guessed. "Naturally, the ice in the muffler melted after the car had been standing in a heated garage for a couple of hours. That was a tip-off, of course, but—well, every man to his trade. Try her now."

THE engine ran smoothly and quietly. "That's fine," Dave said. "But how can I keep the same thing from happening again?"

"Well, I fixed one last year by drilling a small hole in the underside of the muffler," Gus told him. "That let most of the water drain out. But to be on the safe side, in really cold weather race your engine for a few seconds just before you switch it off. That will blow out the condensed moisture before it has a chance to freeze."

Ten minutes after Dave Sledd had driven on his way, Joe brought an elderly man whom Gus didn't know into the shop. "This is Mr. Sinclair," he said. "George Knowles sent him around to us. He's having a little starting trouble."

"That's putting it too mildly," Sinclair protested. "I'm having a lot of starting trouble. It's this cold weather, I suppose. I'm a salesman, and I stayed here in town last night. Left my car parked in that lot back of the hotel. When I tried to get it going this morning the starter worked, but I couldn't get even a cough out of my motor. After I'd tried for a while, and my battery was getting weak, the fellow who runs the parking lot gave me a push with his car, and after a block the motor took hold and ran all right. Thinking that I wouldn't have any more trouble, I went into George Knowles's store, and sold him a bill of goods. When I came out and stepped on the starter, it was the same as it had been before—not a cough. George got me going by pushing me, and suggested that I'd better come in and see you. My car's outside, with the motor running. I was afraid that if I shut it off I couldn't get it started again."

Harry drove the car into the shop. The engine was running

normally. "Cut it off," Gus told him. "All right. Now step on it."

The engine wouldn't start. Gus tilted his cap over one eye as he reflectively scratched behind his right ear. Then he looked over the coil, switch, and wiring. Everything seemed to be in good order, but there wasn't any spark.

"I had a new switch installed, and the wiring gone over, only a week ago. Everything was all right then," Sinclair said.

Gus nodded and began to examine the distributor. "Here's the cause of your starting trouble," he said after less than a minute. "And the cold weather hasn't anything to do with it. Take a look at these screws—the ones that hold down this plate to which one of the points is fastened. Notice that they are a little loose? Some one who was working on your car forgot to tighten them thoroughly and they gradually worked so loose that now there isn't any electrical connection, so, of course, you can't get a spark." He cleaned the part of the plate under the screw heads carefully, and then tightened the screws. "Step on her, Harry," he directed. The engine started promptly.

"That's quick work," Sinclair said. "But there is one thing which I suppose is clear to you, but which just doesn't make sense to me. You say that it was because those screws were loose that I couldn't get a spark to start my motor. I'm willing to take your word for that. But I'd like to know how the dickens I got a spark to keep the motor running after some one had started my car by pushing it."

THAT'S easy. Vibration," Gus explained. "As soon as your engine began turning over fast, it set up vibrations in the distributor that caused contact. Then so long as your engine was running you had an electrical connection, and a spark. As soon as you shut it off, you lost both. Well, it's all right now."

Jobs came into the Model Garage fast that cold day, and Gus and Harry were busy thawing frozen radiators and adjusting carburetors while Joe played a merry tune on the cash register. But for once, it didn't make Joe look very happy.

"What's eating you?" Gus finally asked.

"Oh, as soon as real winter steps in, I get a cold," Joe grumbled in complaint.

"So!" observed Gus.

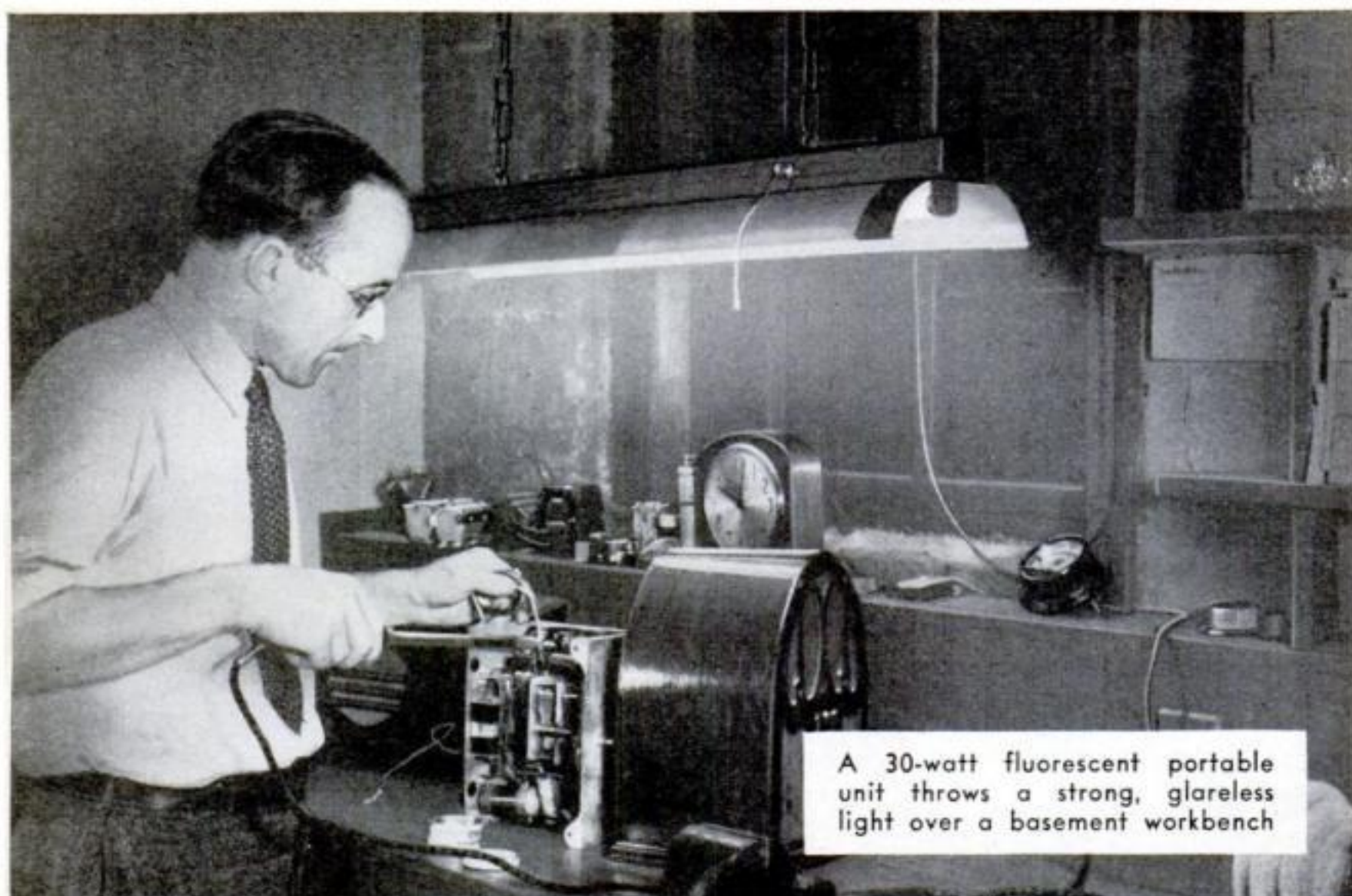
"Kind of sore because you've got to give Doc Marvin a few of your hard-earned dollars? Remember, there's one consolation. In this weather, cars can catch cold, too!"



THE HOME WORKSHOP



In This Issue... **TAKING BETTER PHOTOS • WINTER SPORTS
BARIO • SHOP HINTS • FURNITURE • SHIPSHAPE HOME**



A 30-watt fluorescent portable unit throws a strong, glareless light over a basement workbench

Pointers on Installing the New **FLUORESCENT LAMPS**

FLUORESCENT lamps and fixtures, now available in most electrical supply houses, produce a quality of light that is the nearest approach to daylight yet attained by practical, everyday means. Their efficiency is also much higher than that of comparable incandescent lamps.

A good place to try out one of these amazing daylight tubes is over the bench in the home workshop, or, in fact, in any installation where perfect illumination is required for very fine or exacting work, such as retouching photos, servicing radio sets, building models, making jewelry, or doing delicate needlework. Increased comfort and efficiency and the reduction of heat offset the higher first cost of the lamps.

In the basement installation shown above, a troughlike reflector and two chains comprise the fixture, with a pull-chain switch and a rubber

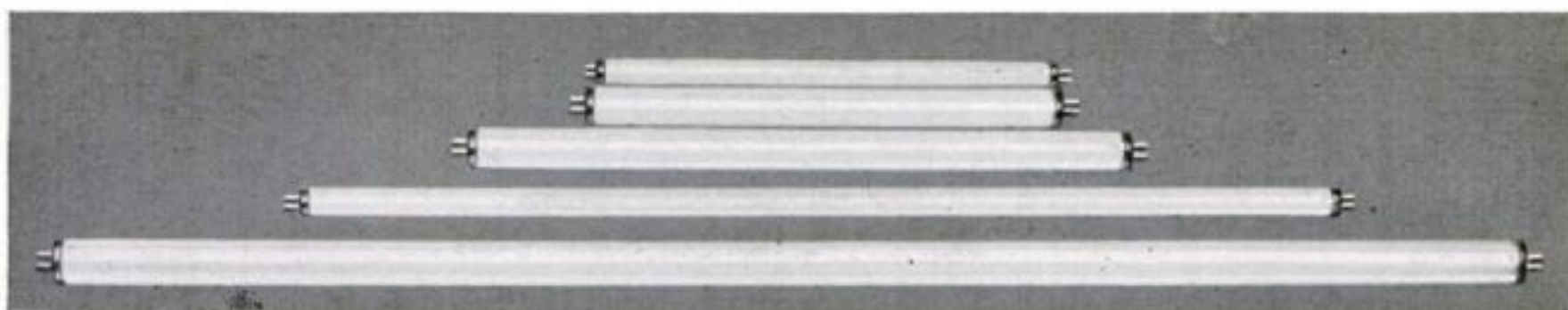
cord and plug. The chains hang on two hooks in the cellar timbers, so the fixture is easily moved about to hang up anywhere. A 30-watt tube is used.

Fluorescent lamps are made in sizes ranging from a 15-watt, 18" tube to a 40-watt, 48" tube. Some are 1" in diameter, others 1½". The tubes contain mercury vapor and argon gas, and at each end, inside, is a cathode or heater. The inside of the tube is coated with a white fluorescent powder. In operation, the mercury vapor arc produces invisible ultra-violet radiation. The visible light is obtained because the ultra-violet acts on the fluorescent powder, making it glow brightly.

As a controlling device, each tube must have an auxiliary that serves to limit the current and aid in striking the arc. This is indicated in the accompanying diagram of a typical lamp and auxiliary circuit. The

**They Rival Daylight
in Illumination but
Give Out Little Heat**

By
HAROLD P. STRAND



Five sizes of fluorescent tubes in common use today. A 40-watt, 48" long tube is shown in the foreground

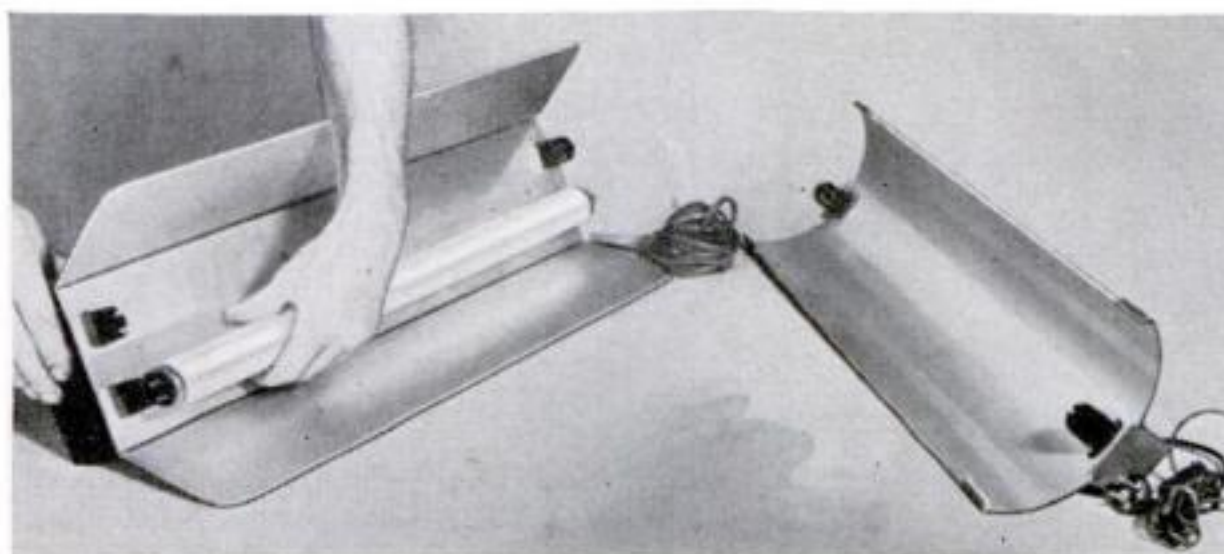
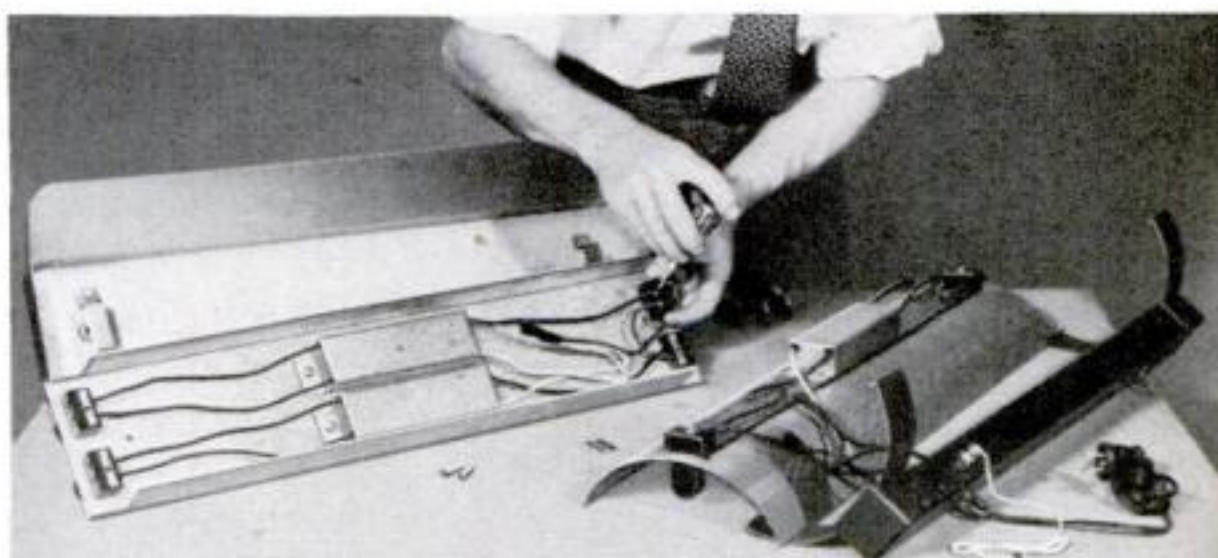
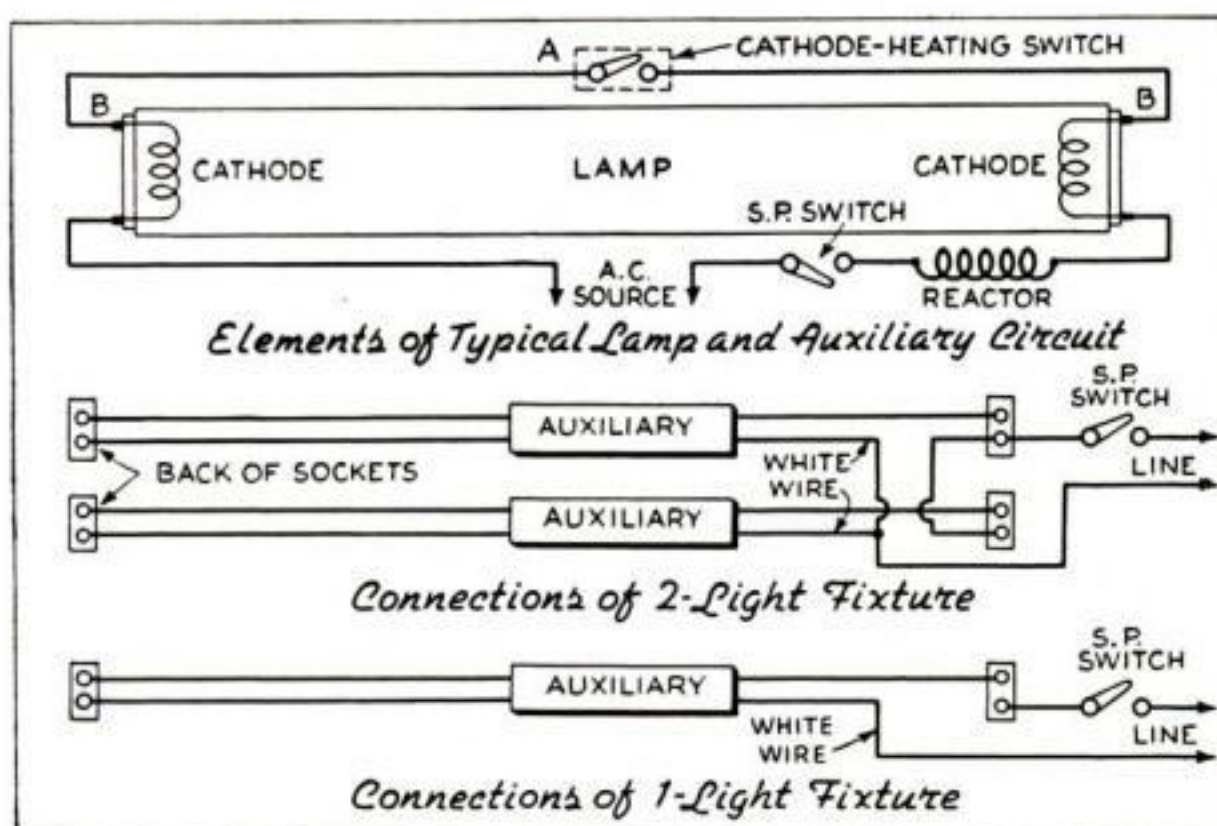
alternating current supply has a reactor or choke coil in series with one side of the cathodes. The other side of each (*B*) is connected with an automatic switch *A*, which may be either thermal or magnetic. With the switch closed, the current heats the cathodes to proper temperature; then the switch opens, interrupting the circuit and thus producing an inductive "kick" between the cathodes, which results in striking the arc.

Prices may vary to some extent, but the lamps range in cost as a rule from about \$1.35 to \$3. The sockets are listed at 40 cents each, and the auxiliaries or starters at \$3.

Installation of these fixtures is simple. They may be made portable or connected permanently to a ceiling outlet by using a canopy and stem on each chain. Run the wires up one chain to the outlet wires and leave the other chain bare. Some types of fixtures are available having a rigid stem and canopy in the center rather than

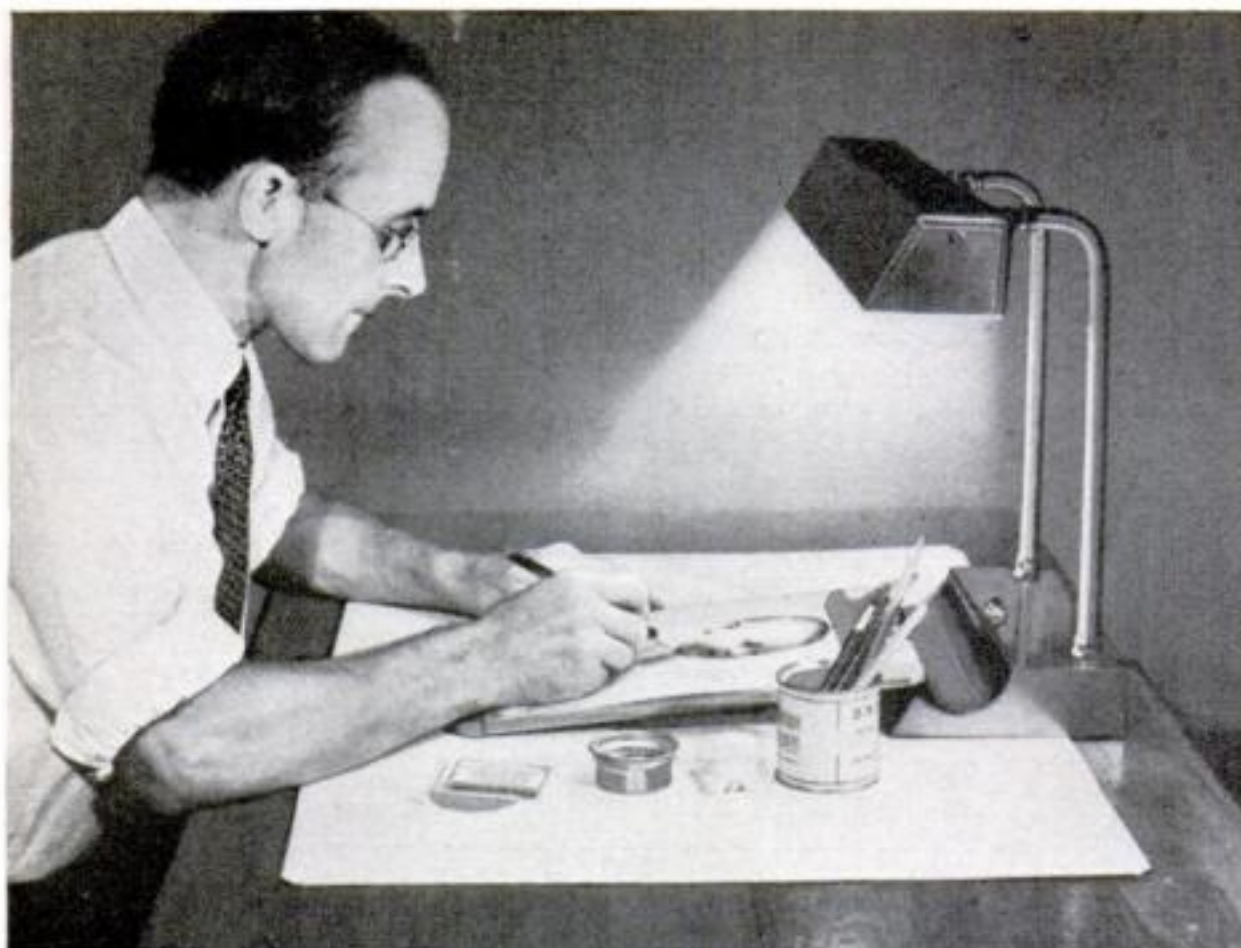
chains. Diagrams are given of the connections for a two-lamp and a one-lamp fixture.

The auxiliary is secured inside the fixture body with machine screws provided for the purpose. Long wire leads connect to the



Wiring a fixture for two tubes with two auxiliaries. The other one is for one light and one auxiliary

Two types of sockets are shown at left. The one being fitted has two slots to fit the lamp pins; the other one has a single slot in which the pins fit vertically. A partial turn then fastens each tube



Portable desk or table lamps with fluorescent tubes can be obtained ready for use. They are excellent for very fine work such as retouching photos

lamp-socket screws. If a switch is desired, it is cut in series with one side of the line as shown. The rubber cord can be brought out through one of the brass loops on top of the fixture or through a hole drilled in the side. Use a rubber or porcelain bushing. One taped splice, which should be soldered, is made of the two white auxiliary wires and one side of the line.

Where a large number of fluorescent units are to be installed, it is advisable to use auxiliaries with a high power-factor rating. The reason is that fluorescent lamps, when

used with plain auxiliaries, have a power factor of only 50 to 60 percent. This is not important with a few lamps, but on larger jobs it may be serious. To overcome this drawback, special auxiliaries are available at higher cost which care for two lamps at a time. These have built-in capacitors to bring the power factor close to unity. Separate capacitors may be used, if desired, with individual auxiliaries.

With a 50-percent power factor one cannot figure the number of lamps possible on a circuit by adding up their wattages, as with incandescent lamps, and dividing by the volts to

get the amperes. The actual amperes would be about twice as much. This is the reason why a 100-percent or unit power factor is desirable.

For illumination of desks and small benches, small portable fluorescent lamps will be found very satisfactory. Even for such exacting work as retouching photographs, a lamp equipped with only a 15-watt tube may be used. This gives 42 foot-candles 18" from the lamp. Lamps of this type come all assembled, ready to plug into your regular circuit.

CONNECTING DRY BATTERIES

[ELECTRICAL]

Dry batteries may be connected in different ways to vary voltage and amperage.

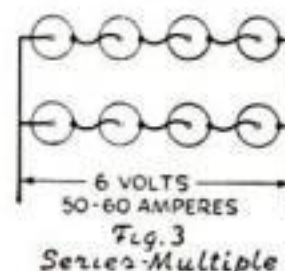
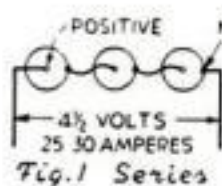
Figure 1 shows a series hook-up of three cells giving $4\frac{1}{2}$ volts, 25 to 30 amperes (depending on the freshness of batteries).

The same series connection is shown in Fig. 2, but using six batteries. This will give 9 volts, 25 to 30 amperes.

In Fig. 3 is a series-multiple connection. This increases the amperage where heavy

current drain is present. Any number of series groups can be connected in multiple as shown, each group increasing the amperage by 25 to 30 amperes. The group shown will give 6 volts, 50 to 60 amperes.

From these examples, it can be seen that other arrangements can easily be worked out for desired voltage and amperage.



POPULAR SCIENCE MONTHLY SHOP DATA FILE

Tray for Melted Butter Rests on Toaster

A DETACHABLE butter tray mounted on top of an electric toaster will supply melted butter, which can be applied to the toast with a white-bristled pastry brush. The materials are a thin piece of bright tin from a discarded coffee can and a bicycle spoke to give the tray a rolled edge. The corners of the tray are soldered.

A frame of angular bar shape to hold the tray in place is made of the same tin and riveted to the top of the toaster as shown at left.



In use, the tin tray rests in a frame or holder on top of the toaster. It keeps butter melted

Folding Circulars Quickly

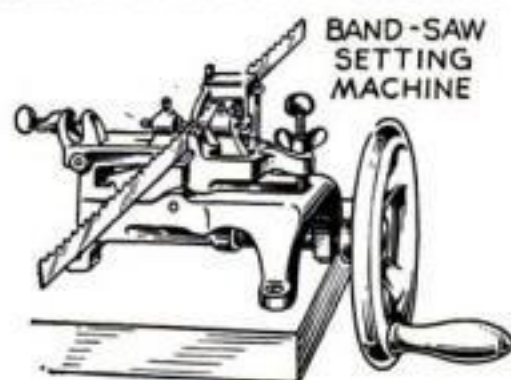
THE folding of circulars and letterheads may be expedited by the use of a printer's trick—the application of a thin film of glycerin on the finger tips. Apply a little glycerin to the back of one hand where the finger tips may be touched lightly as they become dry.—RALPH O. FRITTS.



Cotton for First-Aid Use Kept in Cup Dispenser

IN FIRST-AID rooms and medical stations in factories, department stores, and similar institutions, a practical method of keeping cotton handy is to place the roll in the glass tube of a paper-cup dispenser. The cotton is pulled through the opening at the bottom as required. Either small or large amounts are thus made instantly available. The glass affords sanitary protection and enables the attendant to see how much cotton is on hand at all times.—ROBERT EVANS.

SETTING AND FILING NARROW BAND SAWS [WOODWORKING]



BAND-SAW
SETTING
MACHINE

Narrow band saws are usually set on a small hand-driven machine having two setting hammers and a feed finger, which automatically propels the saw forward. Band saws therefore must have an even number of teeth. Once the machine is adjusted, the setting takes only a few minutes. Only the upper third of the teeth is set.

Arrange the saw on a bench so it cannot slide off during the filing process and clamp it in a special filing vise. Joint the same as a hand-saw and file *all the teeth* straight across. Use a 6" blunt band-saw file, hold it horizontally, raise it on the back stroke, and be careful to preserve the correct shape of the teeth. File another section (about 50 teeth) and continue until completed.

CLAMP FOR FILING NARROW
BAND SAWS



SETTING OF
BAND-SAW TEETH



POPULAR SCIENCE MONTHLY SHOP DATA FILE



Artist's Clippings Hang on Line over Board

MANY artists and most cartoonists use newspaper and magazine clippings as reference material when drawing. These can be clipped as shown to a string stretched across the back of the drawing board.

Phonograph Needle Cuts Celluloid Neatly



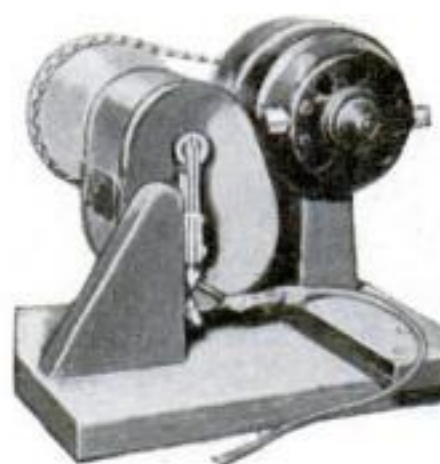
THE easiest way to cut sheet celluloid is to score and then bend it until it breaks. A handy scribe for this and other purposes is made by inserting a phonograph needle into an automatic pencil.—W. K.

Permanent Record of Trips Kept on Jig-Sawed Map

CONFIRMED tourists will find that a "personalized" wall map makes a decorative, permanent record of their trips. The one shown is 25" by 40". The background is a piece of $\frac{1}{4}$ " plywood upon which the oceans and large lakes are painted blue. Land is indicated by $\frac{1}{8}$ " plywood glued onto the background, and the states are stained different colors. Trips are traced on with bronze stripes.—J. B. N.

Pencil Sharpener Driven by an Electric Motor

THE electric pencil sharpener illustrated was constructed by removing the crank from an ordinary sharpener and substituting a sprocket wheel so it could be driven by a motor from a mechanical toy set. The sprockets and drive chain are from the discarded movement

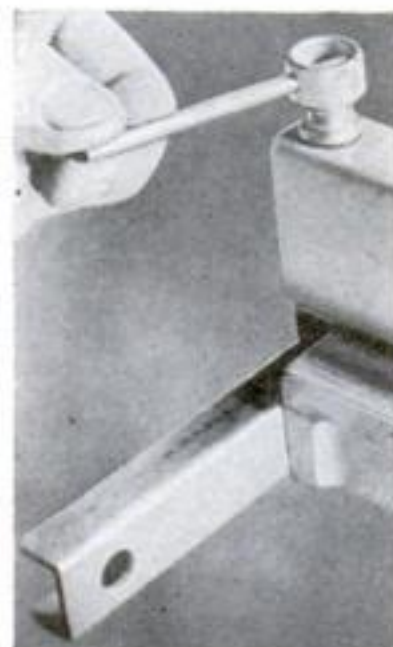


of a player piano. The switch, which is part of an old telephone jack, is so arranged that when the pencil is pushed into the sharpener, the points make contact.—J. G. M.

Improved Clamping Knob for Ripping Fence

THE rear clamping knob used on many small circular-saw and band-saw rip fences sometimes becomes so tight from vibration that it requires a pair of pliers to loosen it. This is not only somewhat annoying, but in time the pliers are certain to damage the knurling on the knob. A better method is to drill the knob and fit in a clamping lever shaped from a large nail or a piece of drill rod.

When in a clamped position, the rod should extend toward the back or unused side of the fence so it will not be in the way. File smooth any rough edges.—H. R. H.





Fish Knife Made from Hack-Saw Blade

A SERVICEABLE fish knife can be made from an 8" or 9" length of heavy hack-saw blade. Grind it to shape and file or grind teeth into the back, then draw the temper in the handle end. Shape the handle from two pieces of maple and fasten with three hard brass rivets, which should be ground flush with the wood. Shellac or wax the wood and sharpen the blade.—J. BRUMFIELD.

Large Cork Holds Supply of Thumb Tacks

ARTISTS and others who have frequent use for thumb tacks will find it convenient to press them into a large bottle cork. This may be cemented to a corner of the drawing board.—C. L.



Thumb tacks are easily removed from the cork

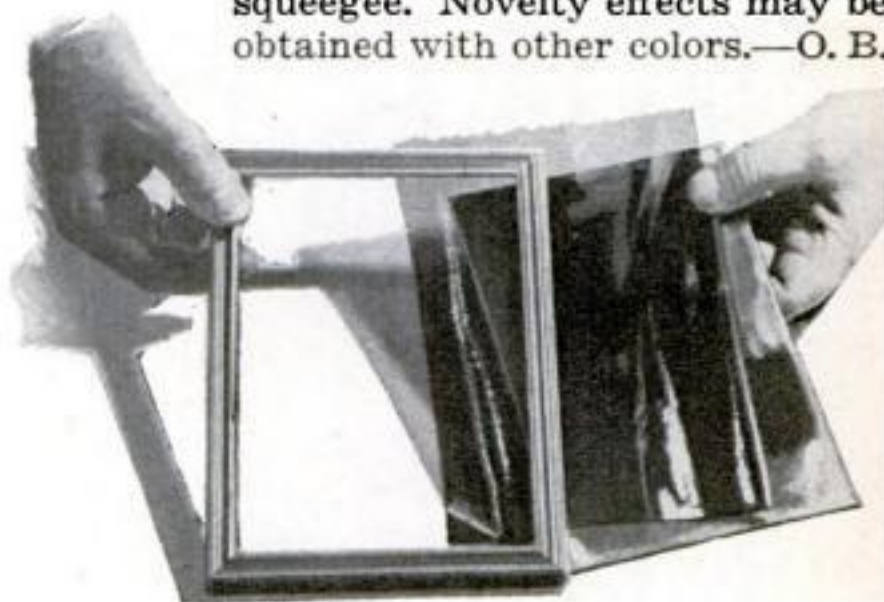
Improvised Pocket Clip for a Refill Pencil



SOMETIMES the clip will break off even the best-made and most expensive refill pencils. When this happens to one's favorite pencil, a clip can be improvised for temporary use by inserting a paper clip under a slip-on eraser as illustrated.—W. S.

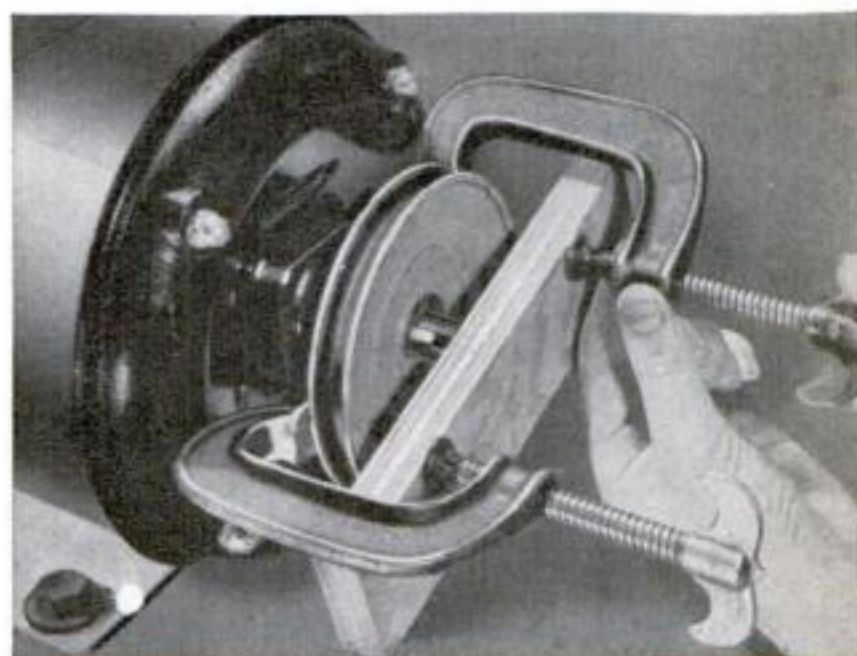
Small Mirrors Colored with Cellulose Film

SMALL colored mirrors are always attractive, and one that is tinted a light red will present a natural-looking reflection when used at the dressing table. All that is necessary to color a mirror is to attach a smooth sheet of colored cellulose wrapping material over the face. If the mirror does not have a frame to hold the color film in place, coat the film with rubber cement, press it into contact with the glass, and rub out the excess cement with a roller or a squeegee. Novelty effects may be obtained with other colors.—O. B.



Tight Pulleys Removed with Two C-Clamps

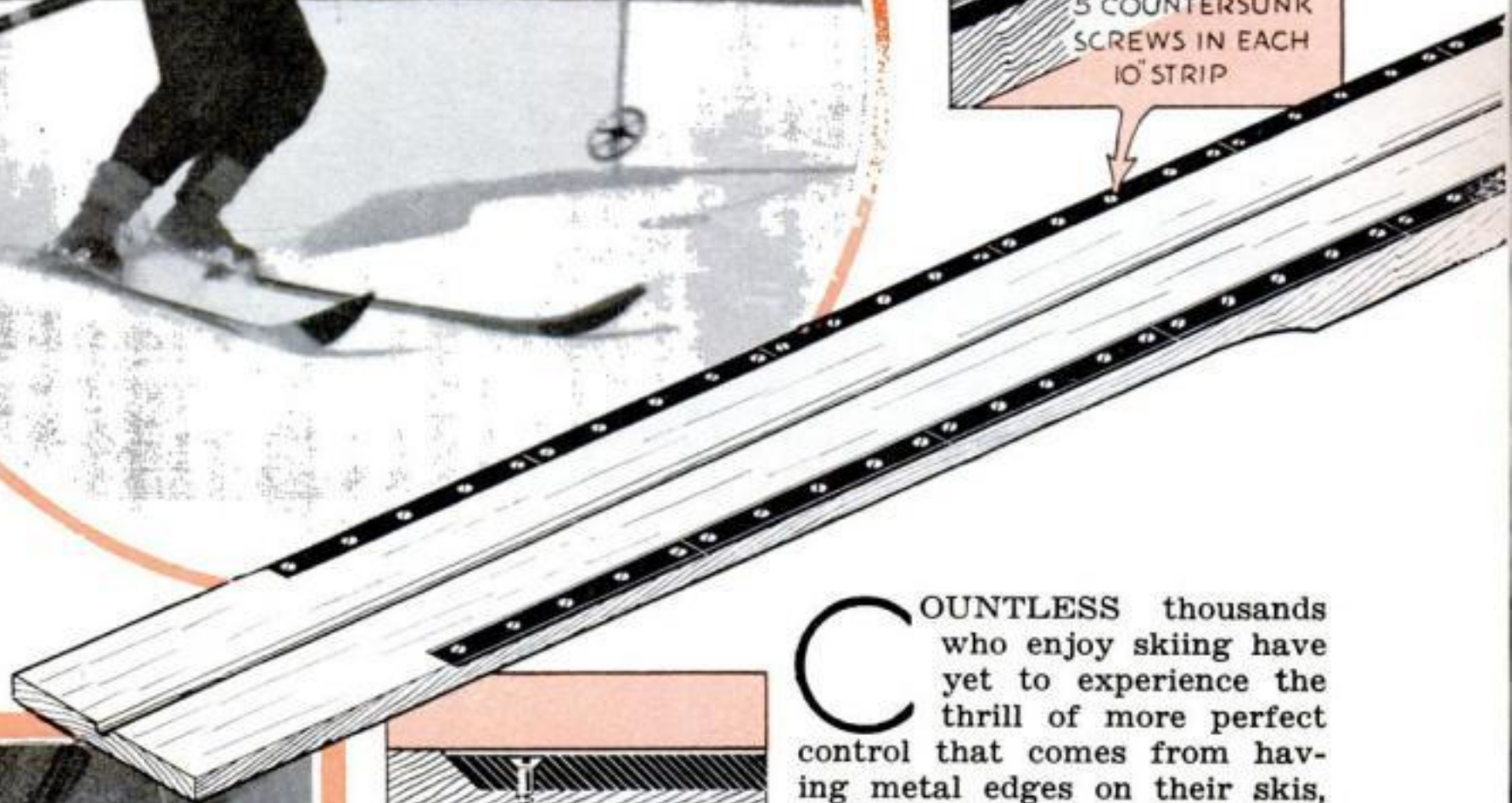
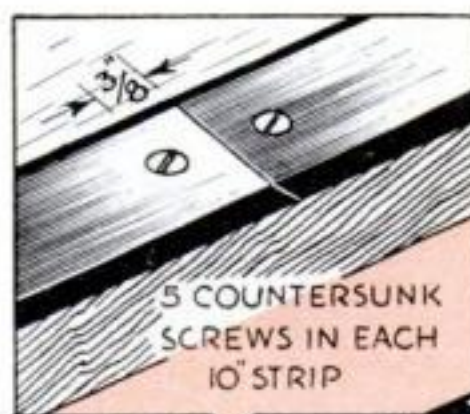
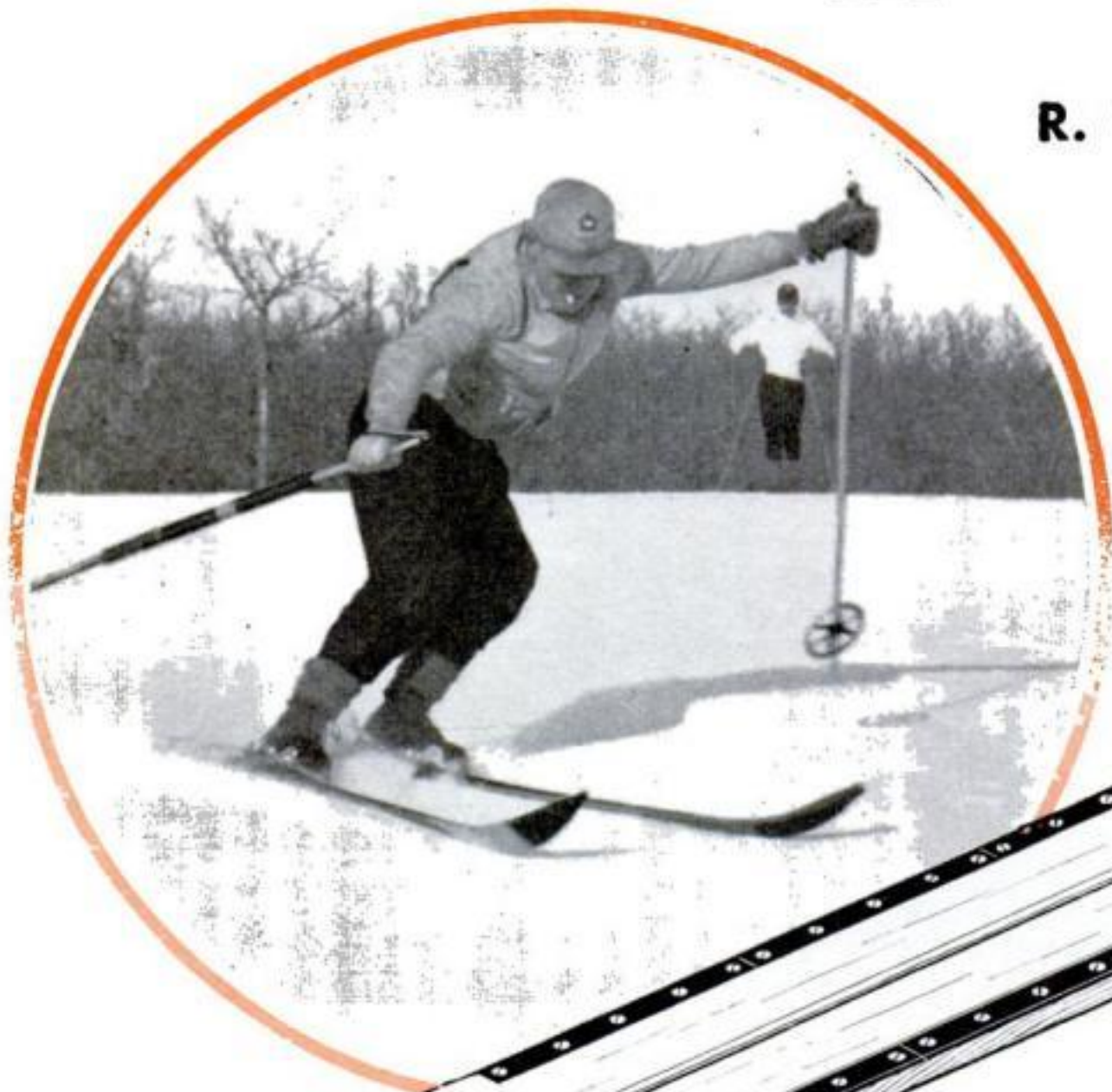
ON HOME workshop machinery, V-belt pulleys often are such a tight fit on their shafts that they are difficult to remove without causing some damage or possibly bending the shaft. A simple method to do this without running any risk of a mishap is to use two clamps and a piece of wood as shown below. The pulley may be drawn right off the end of the shaft by inserting a 1" length of dowel between the end of the shaft and the board.—HOWARD R. HEYDORF.



A piece of wood is placed across the shaft, and two C-clamps are used to remove the tight pulley

Metal Edges Applied to Skis

By
R. O. LISSAMAN



COUNTLESS thousands who enjoy skiing have yet to experience the thrill of more perfect control that comes from having metal edges on their skis, to say nothing of the longer life the edges give the skis.

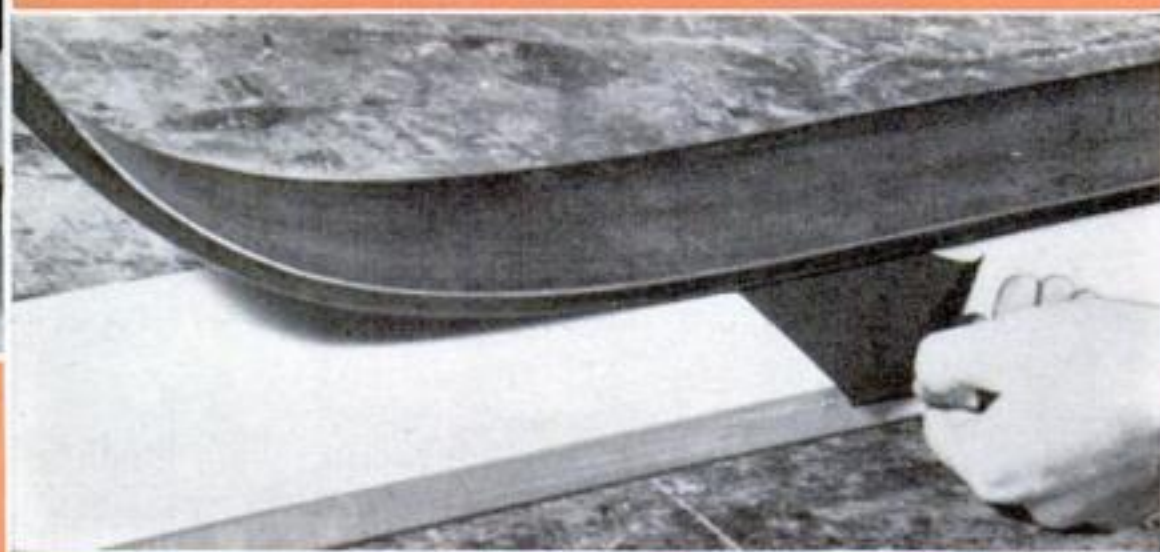
Steel edges may be purchased at large sporting-goods shops ready to apply, but they can also be prepared for less than a dollar from what is called "body



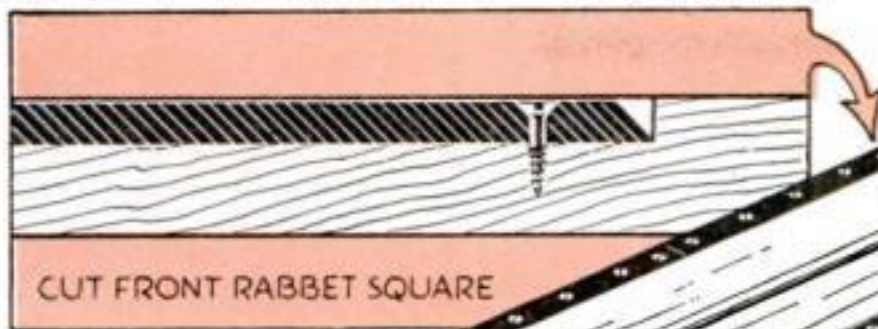
Below, finding where the metal edge should start



Both ends of each strip are beveled uniformly with the aid of a temporary guide attached to the grinding wheel



for Less than a Dollar



CUT FRONT RABBET SQUARE

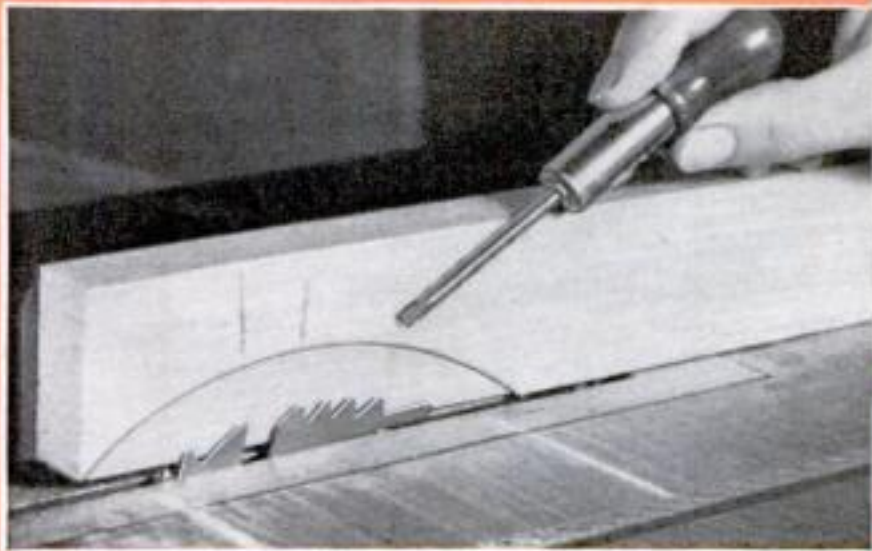
16-GAUGE STEEL
5/16" x 10" SET BELOW
SURFACE OF WOOD

metal." Visit a sheet-metal worker's shop and have him cut for you from twenty to twenty-four pieces of 16-gauge (depending upon the length of your skis) body metal 5/16" wide and 10" long. These must be cut on squaring shears because attempts to hand-shear the strips will result in hopeless stretching and corkscrewing. Even when the metal is cut with guillotine shears, the strips will develop a slight twist, but this is removed by grasping each end of the strip with pliers and twisting in the opposite direction. It does not matter if the strips vary a trifle in width.

A temporary guide should be fixed to the grinding wheel so that each strip may be beveled at each end to an angle of approximately 45 deg. The bevels on each piece should be parallel to each other—



At left, finishing the end of a rabbet by hand. Above, the strips are held securely with small wood screws



Left, a recessed block is fastened to the rip fence so that a sufficiently shallow rabbet can be cut. Above, cutting the rabbet while the ski is clamped to a piece of waste stock

that is, one bevel points up and the other down. Five $\frac{1}{8}$ " holes are next drilled and countersunk in each strip.

The length of the edging is variable. It should, however, begin where the ski starts to bear weight when normally running. This point is usually determined by weighting the ski, while it rests on a level surface, and slipping a card under the front end to determine where it makes contact.

Next, balance the ski over a scrap of wood placed under it at the toe plate, and lay out the edging material along the top of the ski, starting at the point already located. Continue back until the ski balances. This point will usually be from 4" to 6" from the rear end and is where the edging should stop.

There are various ways to rabbet the ski bottoms to receive the strips, and the work can be done by hand if necessary. The method illustrated makes use of the circular saw. Note that a block of wood is secured to the rip fence of the saw, with the blade running in a recess to permit the depth of the rabbet (sideways to the blade) to be less than the blade thickness. The depth of the rabbet should be from $\frac{1}{64}$ " to $\frac{1}{32}$ " more than the thickness of the metal. Chalk marks are



placed on the table at both the front and the back of the blade projection, and these, together with similar marks on the ski opposite the start and finish of the proposed rabbet, permit the desired length of rabbet to be cut. The marks are necessary because the cutting is done blind.

A scrap of $\frac{3}{4}$ " stock is clamped to the top of the ski to lessen the natural bow. Then, since the short block attached to the rip

fence is used as a guide, the rabbet can be cut to a uniform depth because any slight remaining curve or bow will pass around the end of the fence.

In cutting the rabbet, the ski is pivoted on the saw-table edge with the running face pressed against the rip fence and swung down onto the blade. It is pushed the length of the cut and lifted when the chalk marks on the ski top and the saw table correspond. The rabbet ends are squared out by hand.

To attach the edges you will require a gross of $\frac{5}{16}$ " No. 2 or 3 flathead wood screws. Coat the rabbet with boiled linseed oil as you place the edges. Make the screw holes with an awl or drill to prevent splitting. After placing the edging, file any over-width pieces flush with the ski edges.

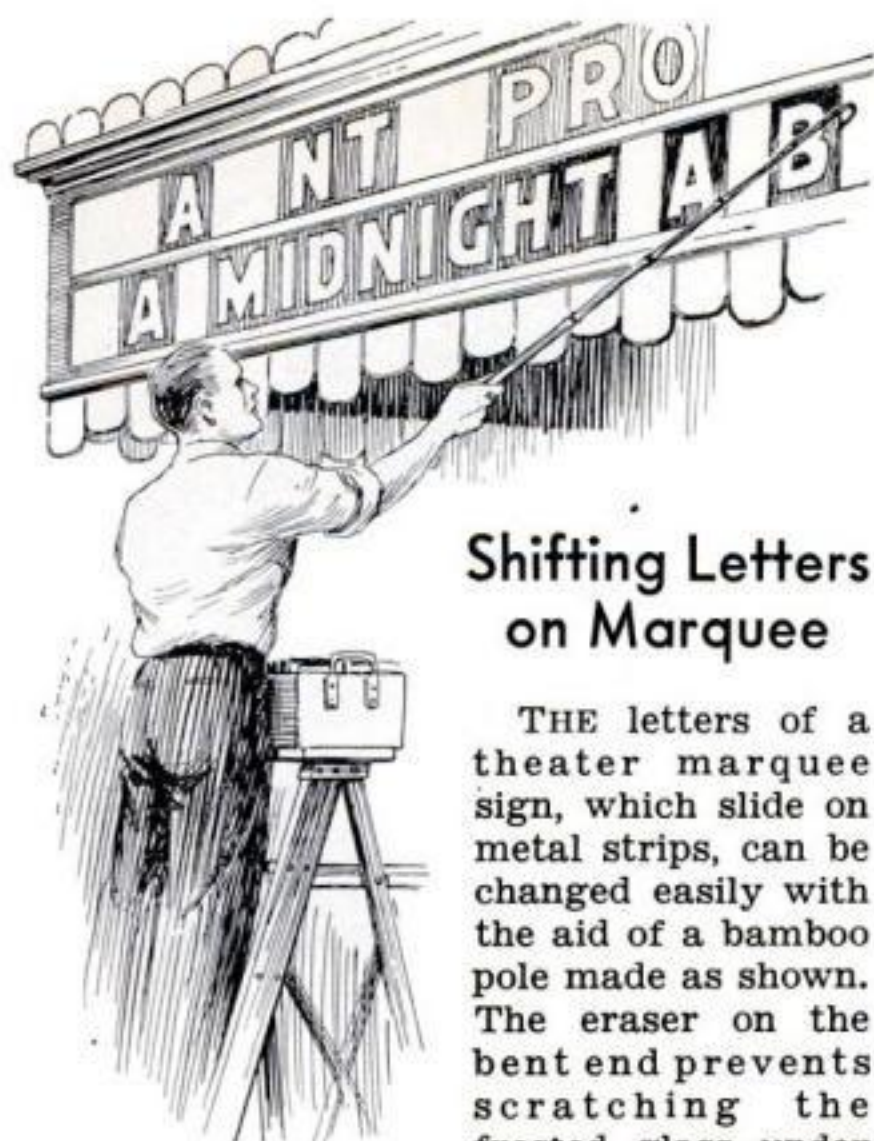
Nontipping Hog Trough Made from Water Tank



After being cut, the tank is pried open with two pairs of "two by fours." In the absence of a helper, one pair is wired to a tree. Right, the trough

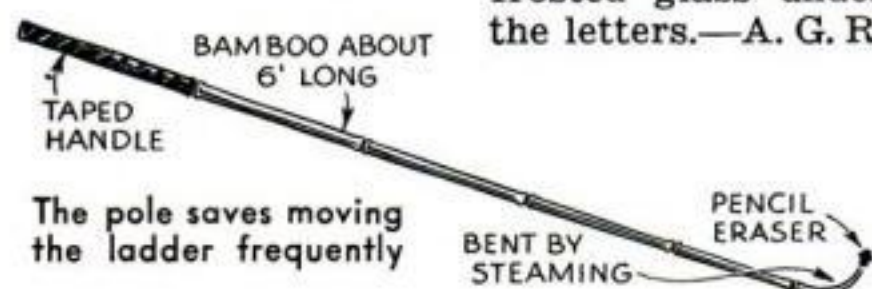
NO LEGS are necessary on this durable double hog trough made from a discarded hot-water tank. The tank is cut along the ends and one side with a torch or by any convenient method. Two pairs of "two by fours" are then hinged together with heavy sheet iron strips and used to pry the tank open as shown. Wires are run over the hinge strips and through holes drilled in the side of the tank opposite the opening, then twisted tightly to hold the "two by fours."—BENJAMIN NIELSEN.





Shifting Letters on Marquee

THE letters of a theater marquee sign, which slide on metal strips, can be changed easily with the aid of a bamboo pole made as shown. The eraser on the bent end prevents scratching the frosted glass under the letters.—A. G. R.



Pencil Eraser Acts as Bottle Stopper

AN ORDINARY slip-on pencil eraser, if placed over the handle of a small paintbrush as shown, acts as an excellent rubber stopper to prevent liquid evaporating in a bottle of touch-up enamel or lacquer.

Monkey Wrench Adapted for Cutting Pipe

A CLEAN job of cutting pipe can be done by inserting a suitable cutter in the stationary jaw of a monkey wrench. A 10" monkey wrench will cut pipe up to 1 1/4". The cutter may be ground from a broken drill bit and inserted in a hole drilled at an angle into the wrench jaw. It is better to drill two holes so that different sizes of pipe may be cut. Holes are also drilled in the knurled adjusting screw in order that a pin may be used to tighten the tool. Pipe cut with this tool requires little reaming. When the cutter is removed, the wrench remains unimpaired for its ordinary use.—B. N.

A cutter is set into a hole in the upper jaw so that the wrench can be used to cut pipe. A pin serves to tighten the tool



A Strong Waterproof Cement

FINELY powdered sealing wax of good quality and rubber cement, mixed in equal parts, form a strong and absolutely waterproof cement. Heat the mixture until the wax dissolves and apply while hot.—K. M.

Odd Candlesticks Decorated with Bits of Baling Wire

BALING wire sounds like an unpromising material for decorative metal work, yet it and all sorts of other cheap or scrap metal can be used by the ingenious amateur craftsman for obtaining odd effects. The candlesticks illustrated, for example, were made simply to see what could be done with two scrap pieces of brass tubing, some waste bits of thin sheet copper, and a coil of discarded baling wire. They were finished by dusting high-grade, colored bronze powders over a coat of bronzing liquid.—M. T.



The SHIPSHAPE



PIPE
FOOT REST

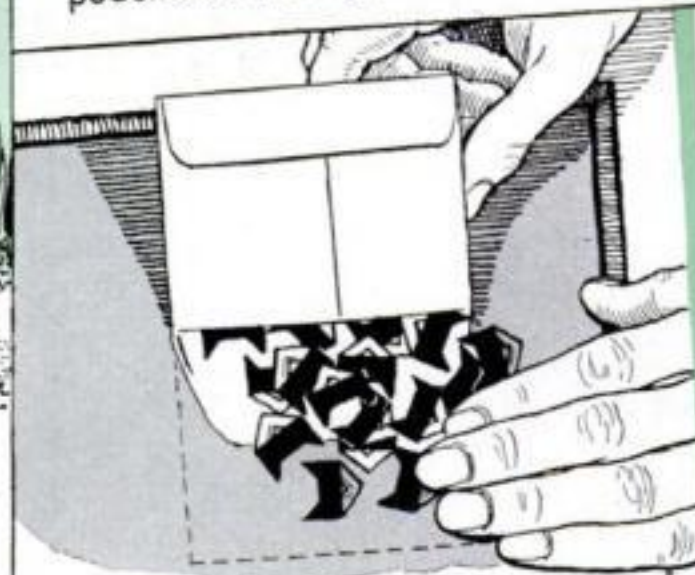
It is less tiring to use a long-handled shovel if a piece of $\frac{1}{2}$ " pipe about $2\frac{1}{2}$ " long is cut lengthwise on one side, slipped on the spade as shown, and wedged with a piece of wood



GLUE
PAN

INDIVIDUAL
EGG POACHER

When only half a cup of glue has to be heated at one time, an aluminum poacher of one-egg size may be used



An envelope stuck on back cover of album holds photo-mounting corners

Below, nail polish is a good seal coat for use under cellulose cement



NAIL
POLISH



WAX



Wax or soap for lubricating nails and screws can be kept handy in a hole drilled into the end of the hammer handle

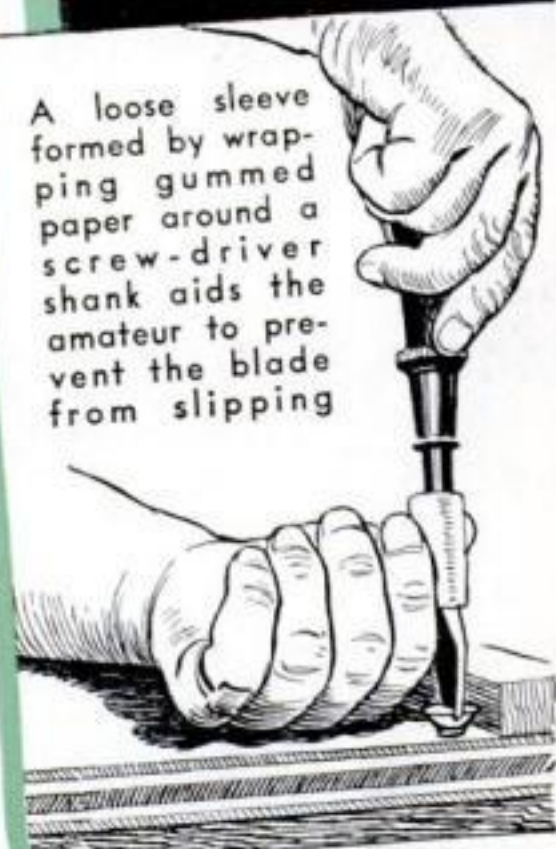
The upper part of a developer can will serve as a coin box for phone tolls. It may be enameled or painted



The threads of gallon food-jar lids can be engaged smoothly if two dots are painted on to mark the start



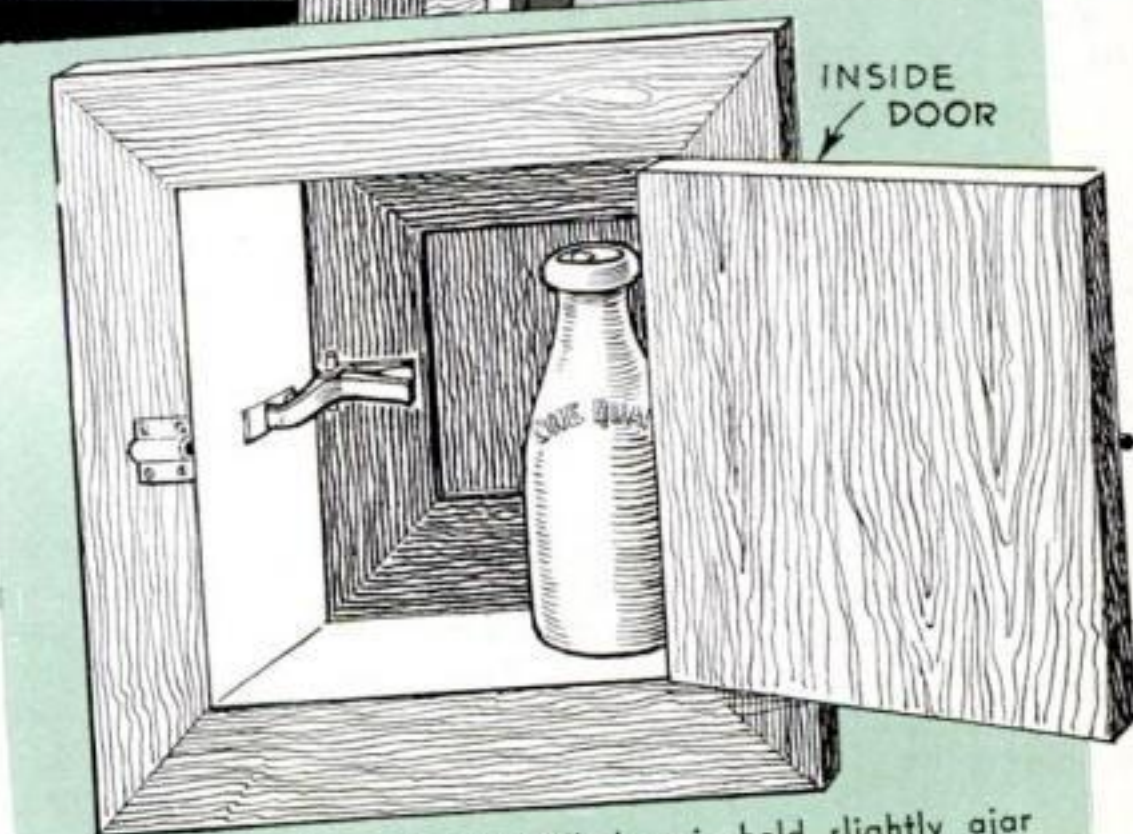
A loose sleeve formed by wrapping gummed paper around a screw-driver shank aids the amateur to prevent the blade from slipping



HOME



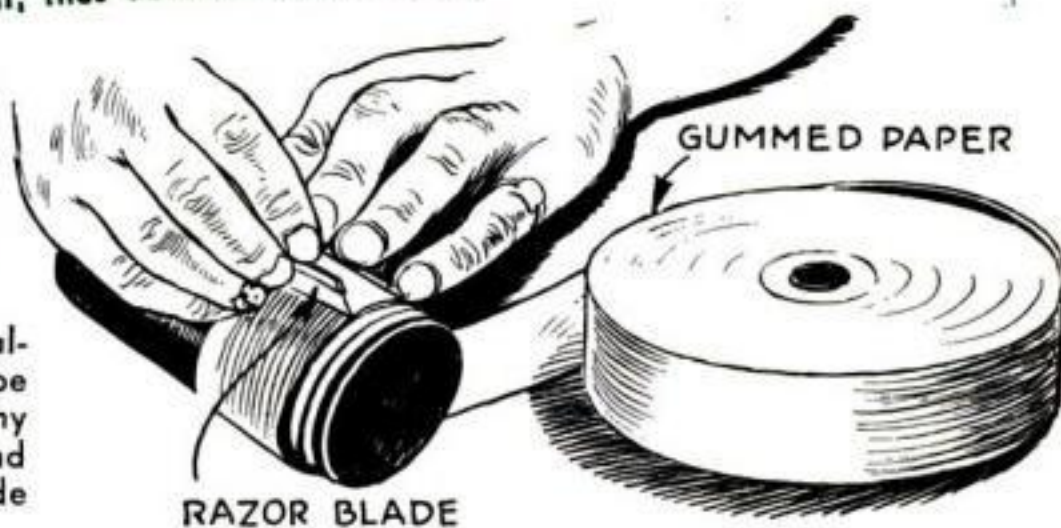
Thin liquid glue is easily inserted into fractured joints of furniture and veneer blisters by using a cheap insulin injector or hypodermic needle. Blisters are treated if possible by drilling a hole for the needle from the opposite side as in the diagram above



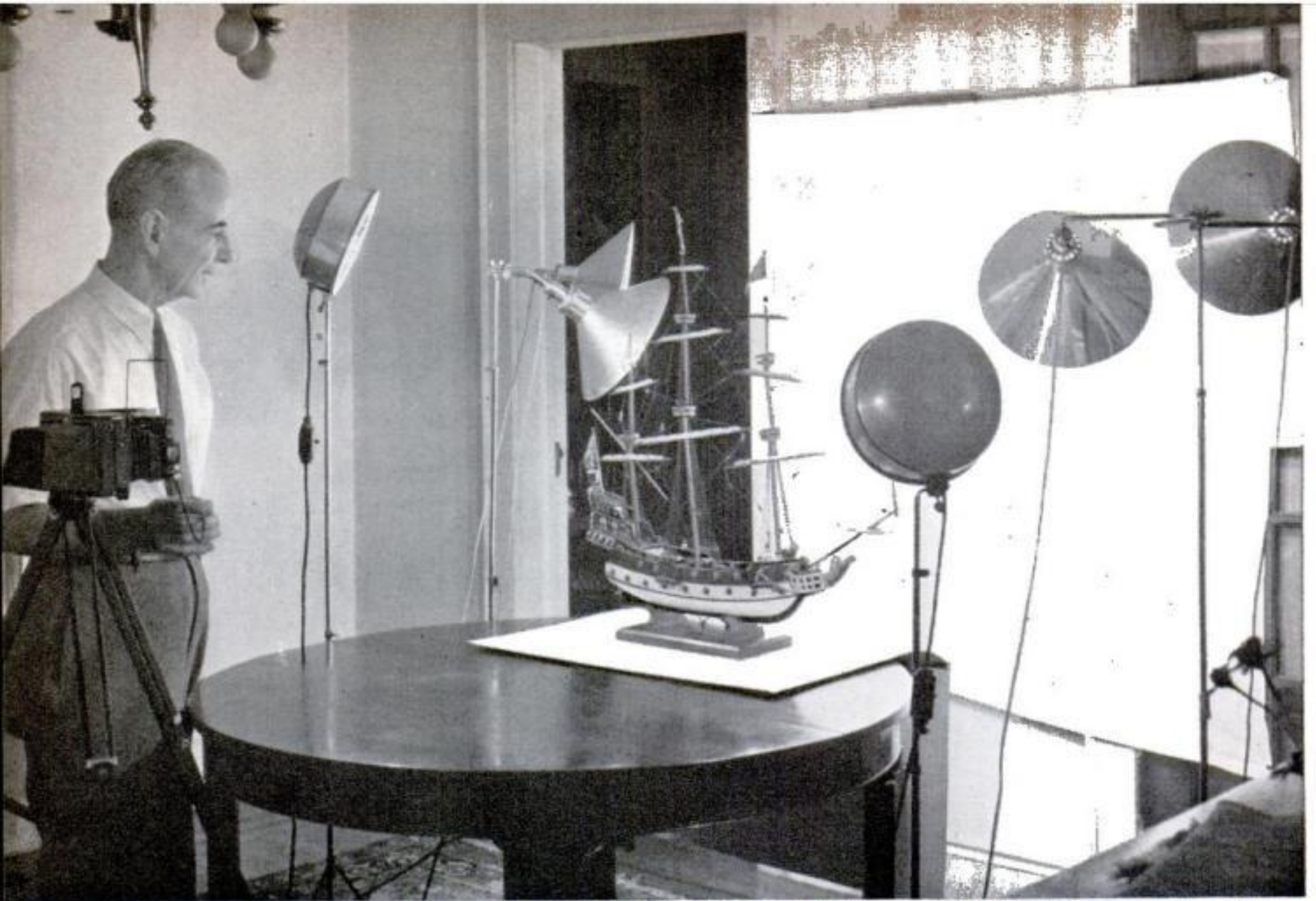
There's no hunting around for a medicine dropper if it is fastened to the bottle with a rubber band or two



The outside door of this milk box is held slightly ajar with an empty bottle. When the milkman comes, he closes it, thus automatically locking it with the cupboard catch



Strips of gummed paper for sealing cartons and envelopes can be cut in quantity by wrapping many turns of the tape around a tube and slicing through with a razor blade



When photographing a ship model, the white background must be illuminated to contrast with the rigging

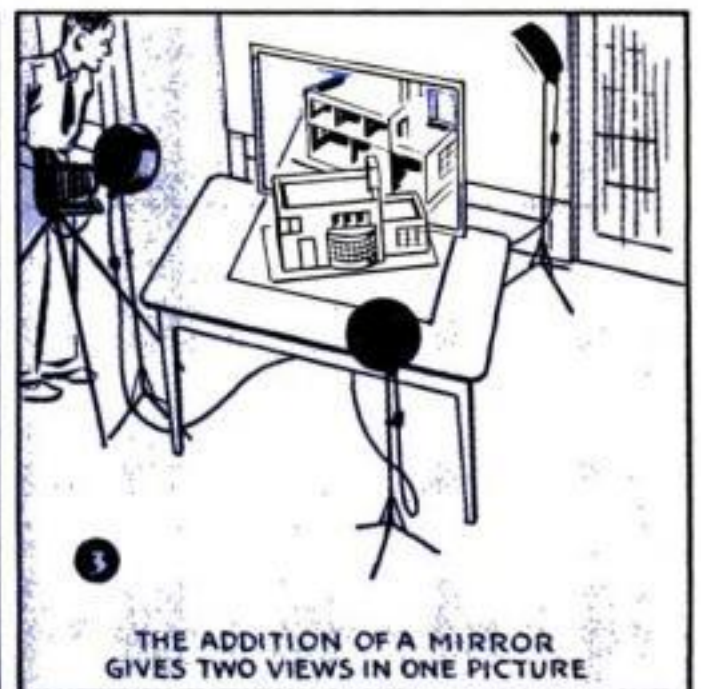
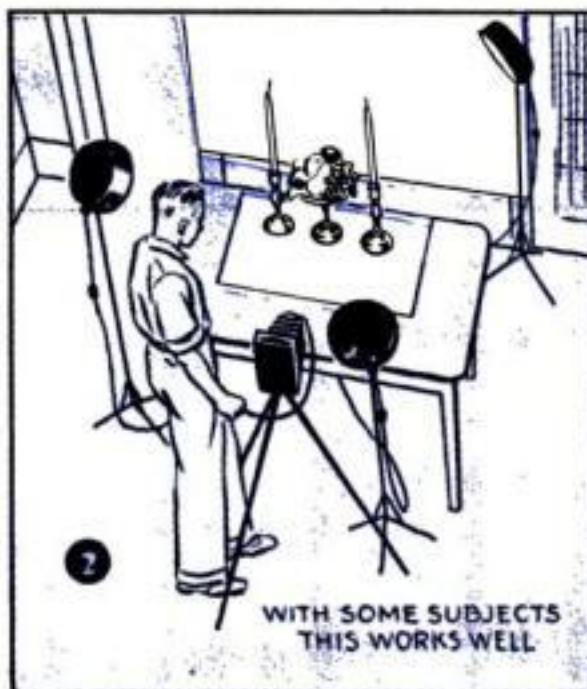
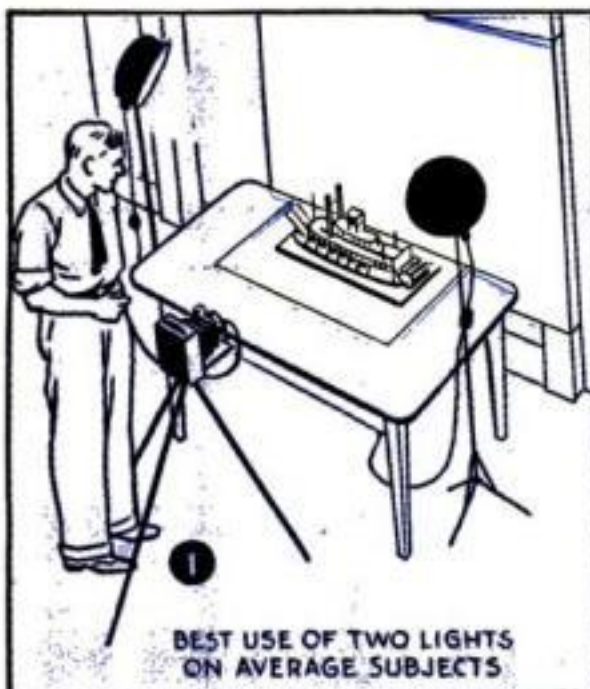
Photograph Your Handiwork

LIKE A PROFESSIONAL

THERE is no form of photography where expensive and elaborate equipment makes less difference than it does in taking pictures of the things you make in your home workshop. If you want to take photographs of your handiwork, just mix a little

headwork with your button pushing and you will get really satisfactory pictures.

Home workshop photography should always be done with the camera firmly supported. The lens should be stopped down to the smallest opening of the diaphragm, and



a full time exposure should always be given.

Be sure to use panchromatic film. Other types of film may make a good picture, but nine times out of ten panchromatic film will give a better one, particularly if the subject is wholly or partly made of wood. This is because wood reflects a lot of red and yellow light, and panchromatic film is the only type that properly records this light.

While photoflood bulbs are helpful because they are powerful and so cut down the length of exposure, you don't have to have them. Just as good a picture can be taken with the same number of ordinary 60-watt bulbs placed in the same positions. The only difference is that the exposure will be ap-

proximately ten times as long. It is the proper placing of the lights that really makes the picture—not their strength.

You can't go wrong in choosing a plain background. A large sheet of cardboard, such as the poster board you can buy at any stationery store, or an unwrinkled sheet of white paper or cloth is suitable as a background for all objects except those painted white or a very light blue or yellow. For such subjects, use a dark gray background. In any case the background should be chosen to contrast with the subject.

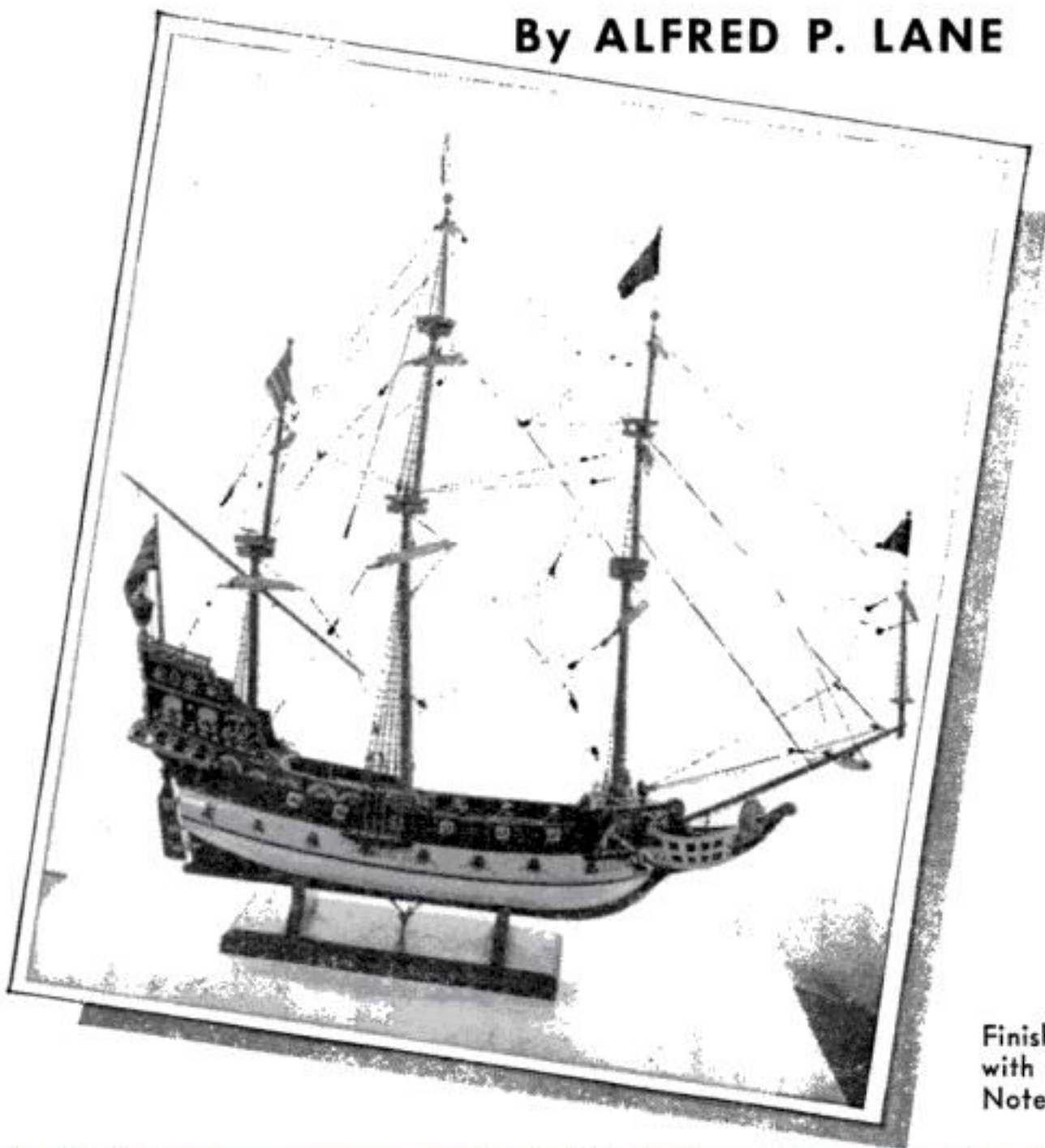
Choosing a background for uniformly colored objects is simple, but when the coloring ranges from white to black, all you can do

is to choose a background that will contrast with the most important parts. Then by careful placing of the lights, use the shadows to prevent the blending of the background with those parts of the subject that have the same tone value as the background.

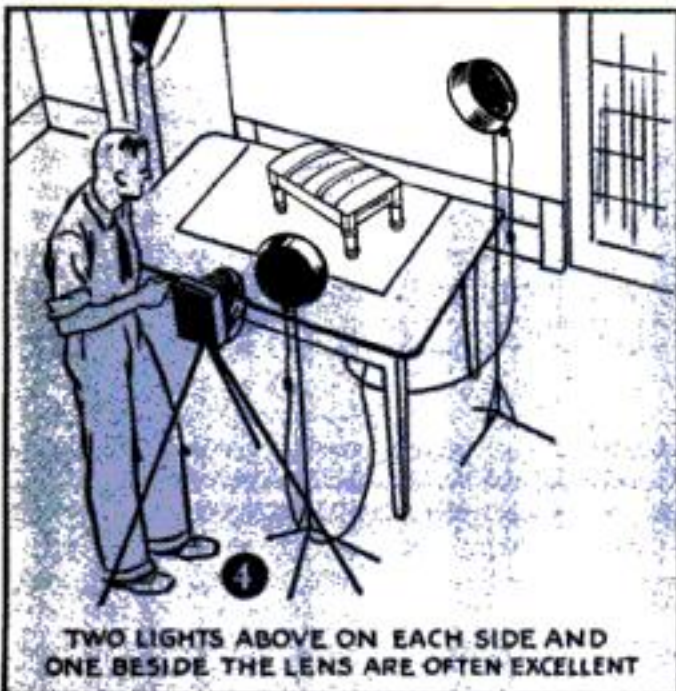
Do not be misled by contrasting colors that appear distinct to the eye and yet may have virtually the same photographic value in black and white. For instance, a bright red object may stand out clearly from a blue background, but the film may see both colors as the same shade of gray.

Often the best solution of such problems is to use a white background with extra light on it so that it will reproduce as blank white paper in the finished print and thus allow the

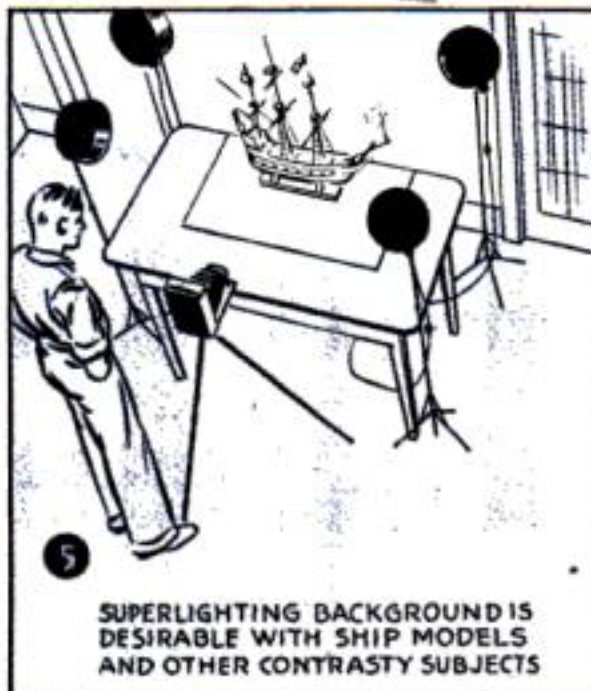
By **ALFRED P. LANE**



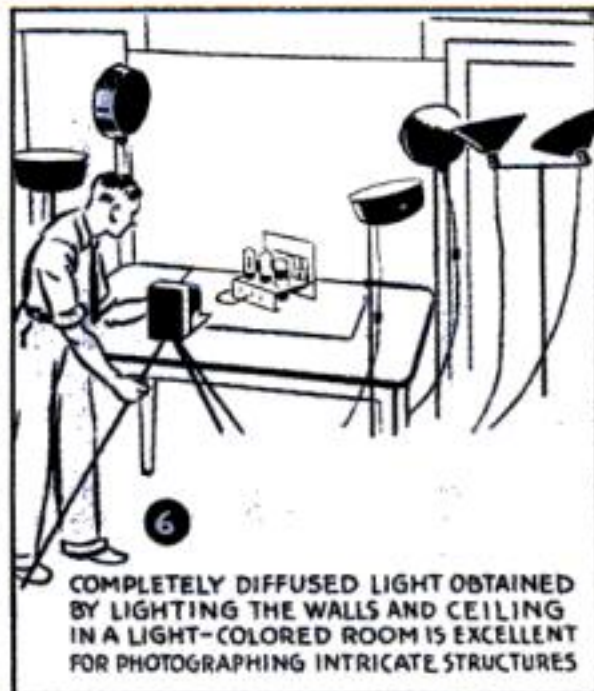
Finished photograph of model taken with set-up shown on facing page. Note how rigging stands out clearly



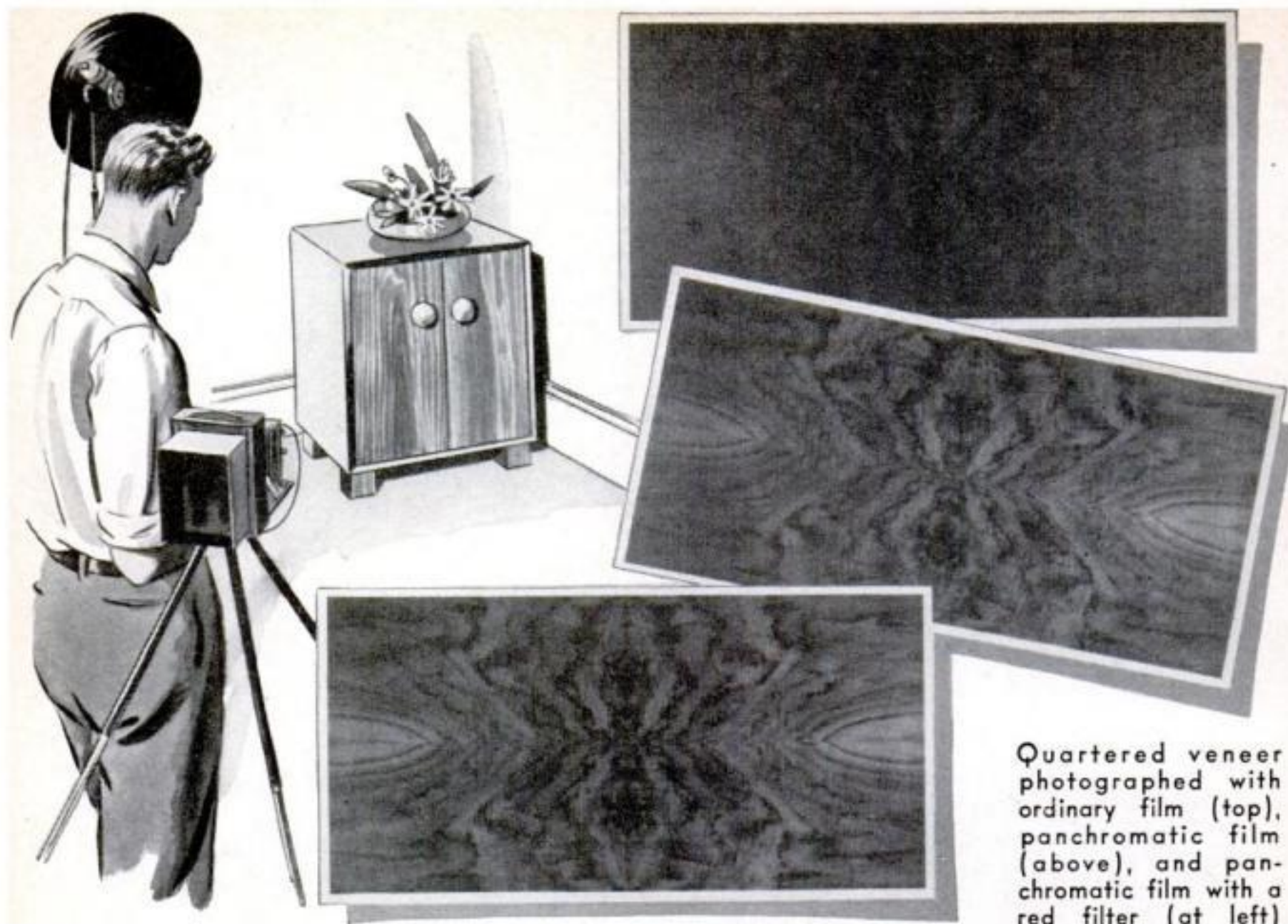
4 TWO LIGHTS ABOVE ON EACH SIDE AND ONE BESIDE THE LENS ARE OFTEN EXCELLENT



5 SUPERLIGHTING BACKGROUND IS DESIRABLE WITH SHIP MODELS AND OTHER CONTRASTY SUBJECTS



6 COMPLETELY DIFFUSED LIGHT OBTAINED BY LIGHTING THE WALLS AND CEILING IN A LIGHT-COLORED ROOM IS EXCELLENT FOR PHOTOGRAPHING INTRICATE STRUCTURES



Quartered veneer photographed with ordinary film (top), panchromatic film (above), and panchromatic film with a red filter (at left)

white portions of the object to stand out against it in a light shade of gray.

In arranging your lights, give special attention to the different surfaces of the object so as to separate them from each other. For example, if you are taking a front view of a rectangular, box-shaped object from an angle so that the top and one side will appear in the picture as well as the front, make sure that the top, the front, and the side are each lighted to a different intensity so that the edges between them will be sharply defined.

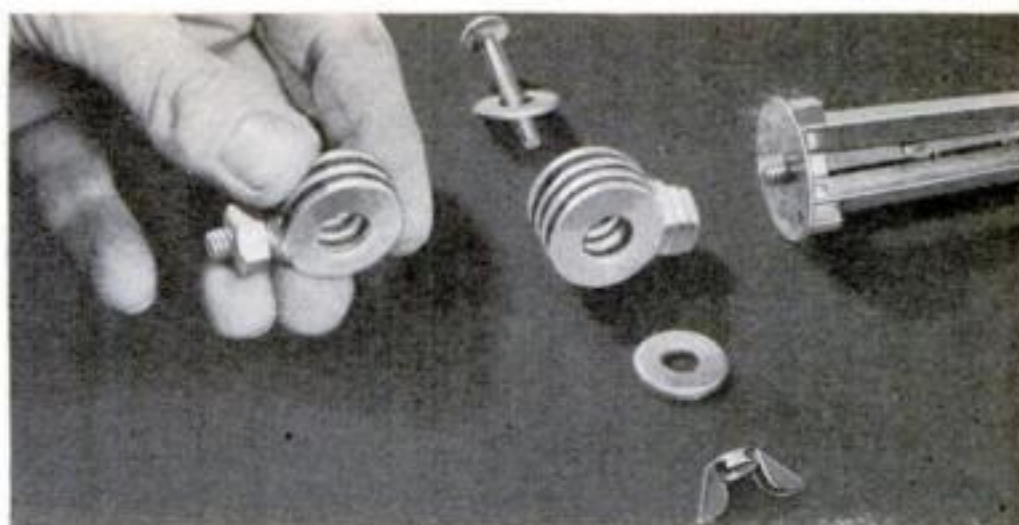
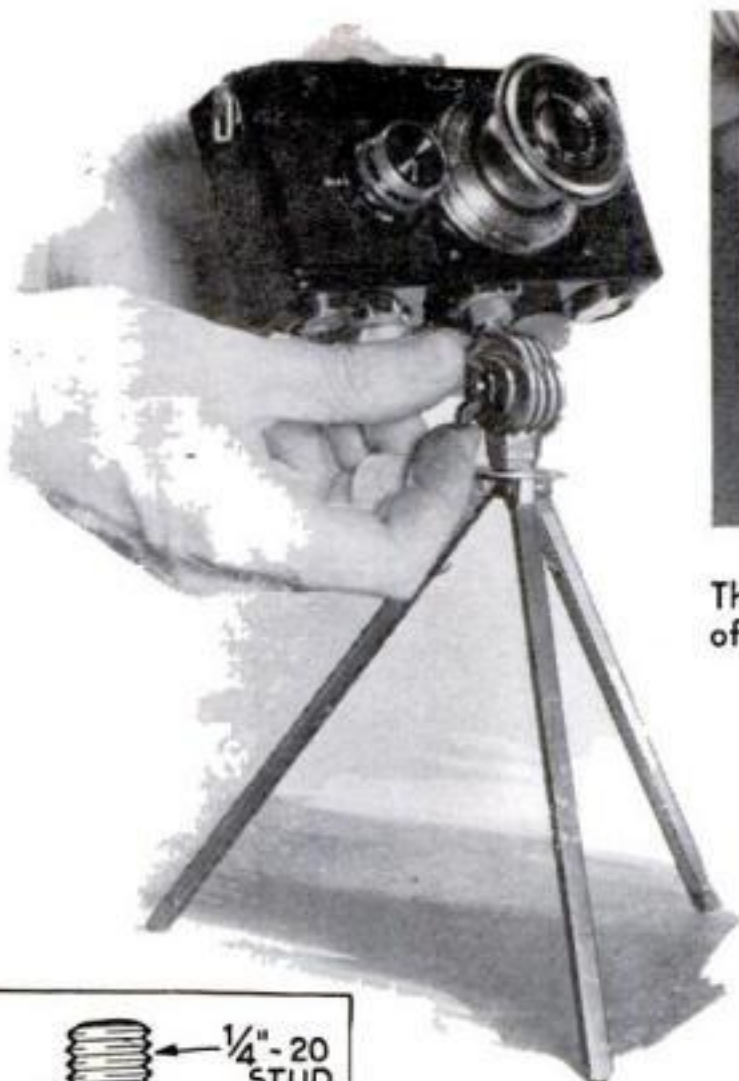
Make sure, too, that projecting parts of the subject are so lighted that the shadows they cast will make them stand out and appear of their proper shape. The nearest light should cast the shadow, and a light farther away should be placed to throw some light into the shaded area. One simple way to accomplish this result is to place one light as close to the camera lens as possible so that this light will lighten the shadows cast by the other lights shining on the object from both sides.

Some objects are extremely difficult to light because there are so many projections and attached small parts. The bottom view of a radio chassis showing the parts and wiring is an extreme example. The correct way to photograph all such subjects is to abandon direct lighting entirely. Use complete-

ly diffused lighting. Do the job in a room with light-colored walls and point the lights at the walls and ceiling in front of and on both sides of your subject. Do not have any direct rays fall on the subject or on the lens. The exposure will be relatively very long—anywhere from ten to thirty or more times as long as with direct lighting.

The use of completely diffused light is also often the only simple way to get a good picture of an object that has a shiny varnished finish, especially when the varnish job is not so good. Nearly all projects will give a better picture if they are photographed before the final finish is applied.

Getting the best possible picture of an object made of, or veneered with, fancy figured cabinet woods often calls for a bit of experimenting to bring out the grain. Move a single light all around so that the wood is illuminated from various angles. You will find, with most fancy woods, that their natural beauty is usually much more apparent when the light strikes from one particular angle. With careful lighting, the figure in many kinds of woods will photograph nicely without the aid of a filter. In other cases a deep yellow "G" filter will improve results, and with dark-colored woods, particularly those with a red tone such as mahogany, a red filter such as "A" or even "F" will give a startlingly vivid effect.

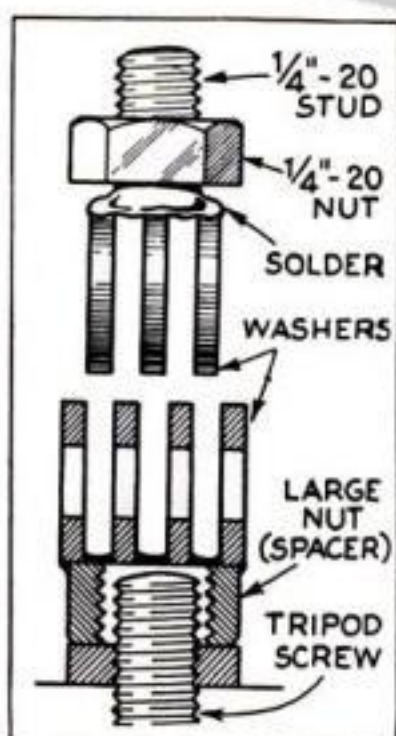


The parts of the tilting tripod head. The size and number of washers depend upon the strength required for the unit

Tilting Tripod Head Formed from Large Washers

STACKED washers form the locking mechanism for a simple tilting tripod head that enables a camera to be swung at any angle from straight up to straight down. That shown employs seven washers measuring 1" in outside diameter, about $\frac{3}{32}$ " thick, and having $\frac{7}{16}$ " holes.

Obtain a short length of $\frac{1}{4}$ "-20 bolt to fit the camera tripod socket, and two nuts of the same size. Also get a small bolt, say 10-24 size, and a wing nut and two smaller washers, about $\frac{3}{4}$ " in outside diameter, to fit it. Stack the big washers, run the bolt through them, and tighten the wing nut lightly. With a screw driver, stagger the washers so that every alternate one extends beyond the others about $\frac{1}{4}$ ". Line up the washers so their edges are even, and solder or braze the $\frac{1}{4}$ "-20 stud to one set and one of the $\frac{1}{4}$ "-20 nuts to the other. Run the remaining nut on the short stud, to be used as a lock nut. It may be necessary to use a spacer between the other nut and the edges of the washers to which it is attached, to provide room for the tripod screw. A larger nut, having a hole that a $\frac{1}{4}$ "-20 bolt can enter without jamming, will serve.—W. E. B.



The parts can be soldered, but it is better to braze or weld them



As the slide holder is moved, a piece of black cardboard is lowered before the lens, then raised

Operating Single Stereopticans

DISSOLVING-VIEW stereopticans are costly compared with a single-lens projector, but the latter can produce a similar effect if a double slide holder is used. Hold a piece of black cardboard in the left hand and, just before the slide holder is to be pushed along to show the next view, lower the cardboard before the lens. Synchronize the motions. Then, not too rapidly, lift the cardboard.—L. B. ROBBINS.

A Varnish for Photo Prints

A PROTECTIVE varnish for photo prints consists of 1 oz. sandarac, 4 oz. benzol, 4 oz. acetone, and 2 oz. absolute alcohol. Filter through muslin when solution clears, and apply with a camel's-hair brush.



Mirror Helps Take Candid Snapshots

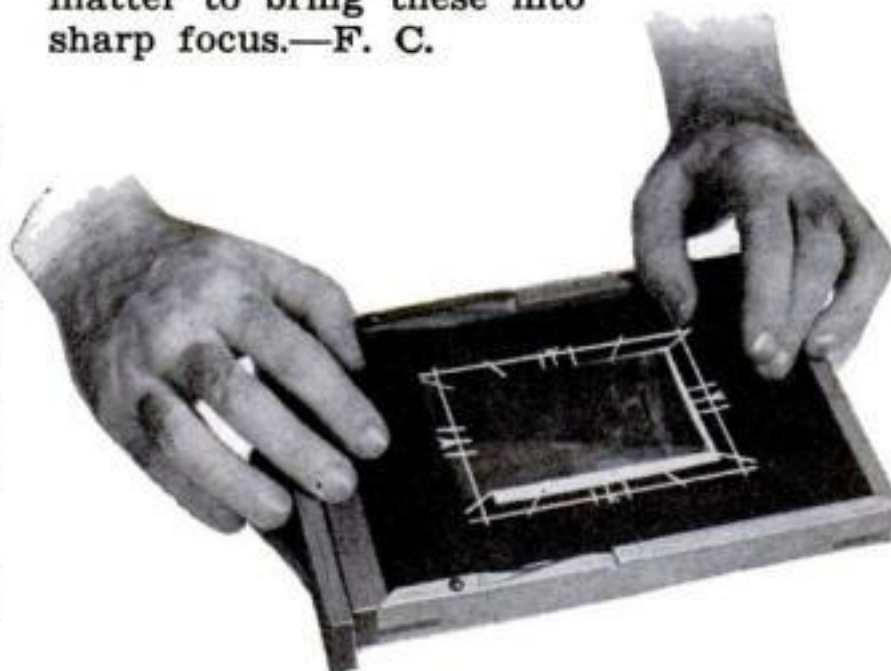
OWNERS of miniature cameras will find that so-called "candid" shots are easier to make if they do not themselves face in the direction of the unsuspecting subject. This can be accomplished by hinging a small strip of mirror at one end with adhesive tape to the camera in such a way as to cover the focusing and sighting windows. With a little practice in holding the camera, you can then face at right angles to a subject while snapping a picture.

Special Enlarging Mask Saves Focusing Time

IF A MASK is made as shown to fit the negative carrier of an enlarger, it is possible to focus very accurately without loss of time or the extra handling that is necessary when a separate focusing strip is used.

The mask is a very dense negative made by exposing a film to the light and developing it. This must be at least 1" wider and longer than your regular negatives. On it score a series of vertical, horizontal, and diagonal lines; then cut out the center to suit the negatives you intend to enlarge. If this mask is not sufficiently large to fit the negative carrier, it can be mounted on black paper.

When a negative is inserted in the mask and projected on the enlarging easel, the image will be surrounded by the lines of the mask, and it is a simple matter to bring these into sharp focus.—F. C.



FLASH-BULB EXPOSURE GUIDE

[PHOTOGRAPHY]

Distance (in ft.) from Lamp to Subject	9			12			16			25			35		
	16	32	64	16	32	64	16	32	64	16	32	64	16	32	64
Weston Tungsten Emulsion Rating															
A	f/11	16	22	8	11	16	5.6	8	11	4	5.6	8	....	....	....
B	f/16	22	32	11	16	22	8	11	16	5.6	8	11	4	5.6	8
C	f/19	27	....	13.5	19.5	29	9.5	13.5	19	6.3	9.5	14	4.5	6.3	9.5
D	f/22	32	....	16	22	32	11	16	22	8	11	16	5.6	8	11
E	f/27	....	....	19	27	....	14	19	27	9.5	14	19	6.3	9.5	14

A—No. 0 Superflash; B—No. 1 Superflash or No. 11 Photoflash; C—Press 40M Superflash or No. 7 Photoflash; D—No. 2 Superflash or No. 16 Photoflash; E—No. 3A Superflash or No. 21 Photoflash.

Note: The figures in the table above are lens apertures when the camera has been set for "time" or "bulb."

POPULAR SCIENCE MONTHLY SHOP DATA FILE



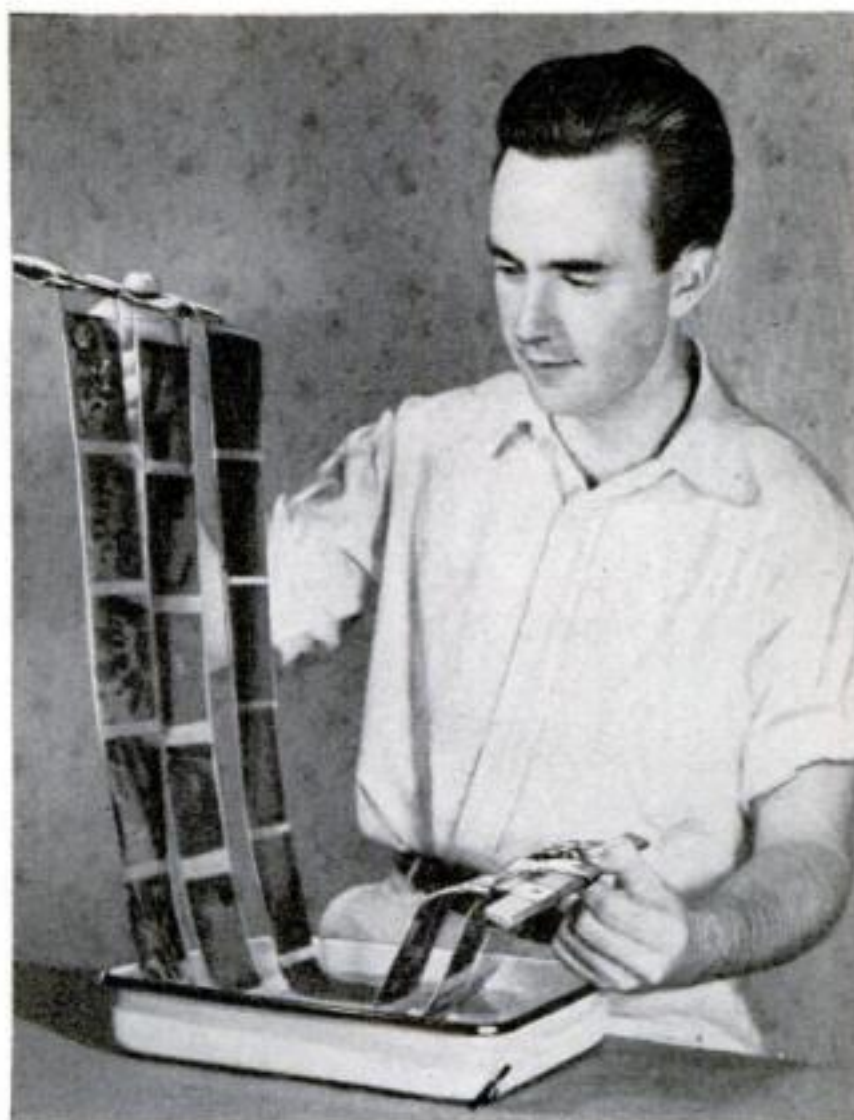
Electric Mixer Used to Agitate Roll-Film Tank

AN ELECTRIC food mixer can be utilized to agitate roll films in the tank during development — but get the permission of the housewife first! Two geared wheels of a ratio of about $7\frac{1}{2}$ to 1 are used. The wheels il-

lustrated are of bronze and cost 25 cents a pair at a secondhand hardware store.

The large wheel is slipped over the agitating pin and held in place at a suitable level by tape on both sides. The small wheel is fastened to the end of a $\frac{5}{16}$ " dowel. The length will vary, but it should be long enough so that when the mixing device is set up, the gears mesh easily. The free end of the dowel rod is given two saw cuts at right angles to each other so that it can easily interlock into the socket of the rotating spindle.

Select the spindle that turns the reel in the direction the film is wound, or else the film may unwind and be ruined. Use the lowest speed of the control knob on the mixer. A few folds of newspaper underneath the tank will afford sufficient friction to prevent the tank from slipping, keep the geared wheels engaged, and also absorb any overflow of developer.—SAMUEL HARELICK.



Several Rolls of Film Developed at Once

FROM three to five roll films, provided they are of similar size, may be developed by the tray method shown in the same time it would ordinarily take for one roll. This is done by passing a stick about a foot long through the film clips at each end of the rolls.—ROBERT SCOTT.

WATER

[PHOTOGRAPHY]

If practical, it is best to use distilled water for all solutions. Tap water, however, is quite satisfactory providing it is free from suspended matter and contains very limited quantities of such impurities as calcium, magnesium, iron, and sulphur.

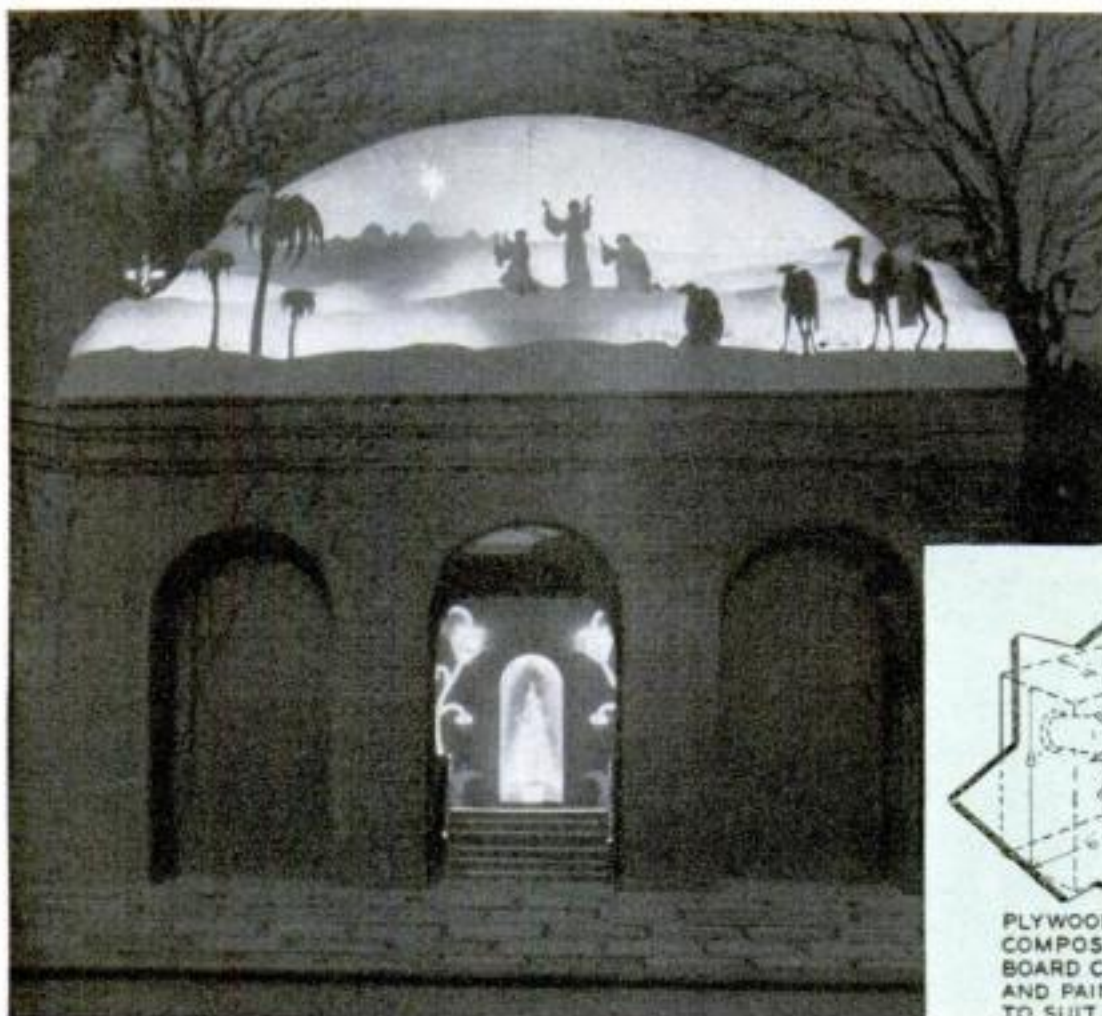
The following methods of purification may be used when necessary:

Boiling and settling. This causes nearly all suspended matter to coagulate and precipitate to the bottom. Boiling drives off hydrogen sulphide and precipitates a large proportion of the calcium and magnesium salts. Unless the water is badly contaminated, this method is sufficient.

Chemical. Boiling will not eliminate soluble calcium or magnesium salts. A solution of either sodium or potassium oxalate may be added a little at a time till no further precipitate forms. Filter or decant.

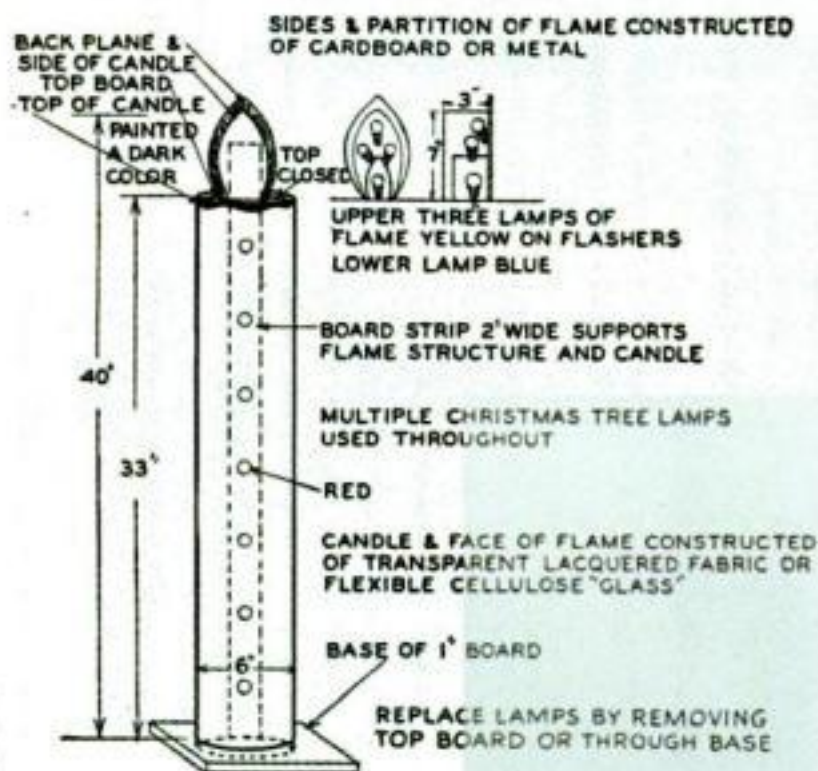
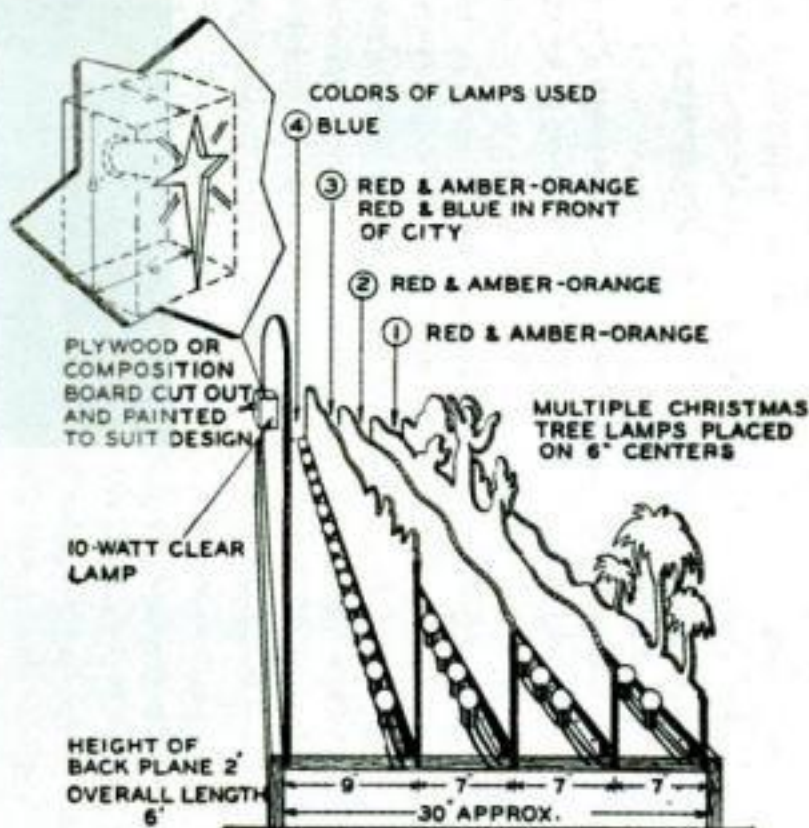
POPULAR SCIENCE MONTHLY SHOP DATA FILE

Christmas Lighting Effects



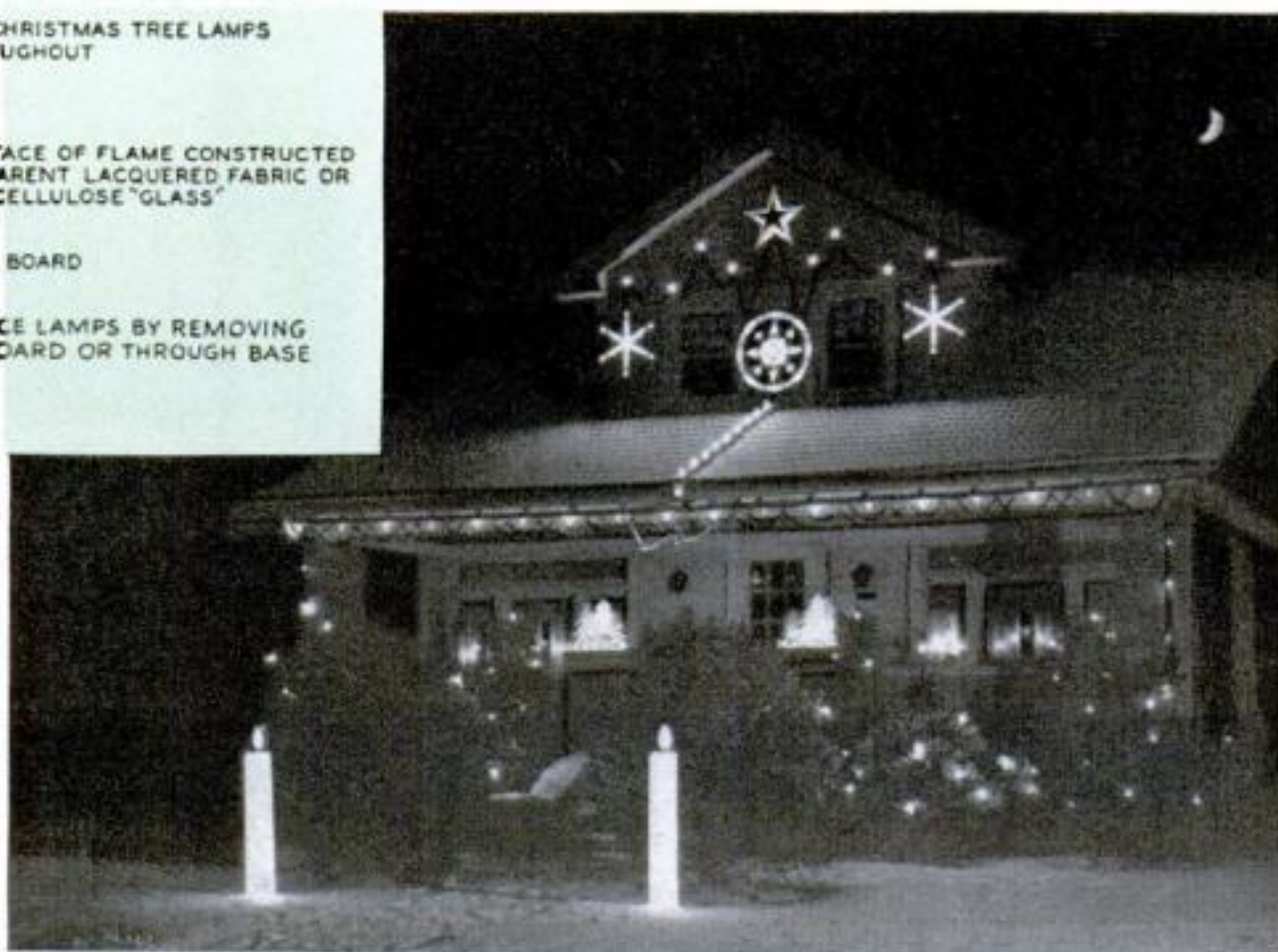
SYMBOLIC CUT-OUT DESIGNS

Holiday lighting presents unlimited opportunities for exercising imagination and ingenuity. Among the most picturesque displays are those of a symbolic nature cut from composition board and arranged in three planes. These are of approximately the same shape, but proportionately larger the farther back they are mounted. The lamp strings are used as shown below

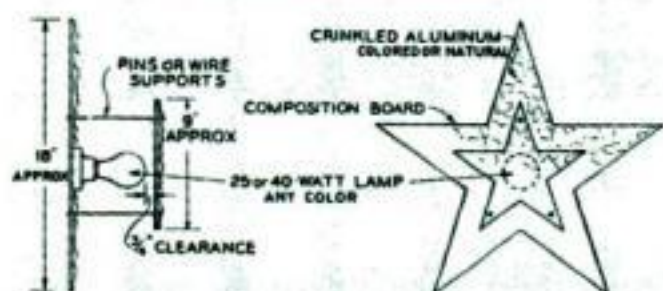
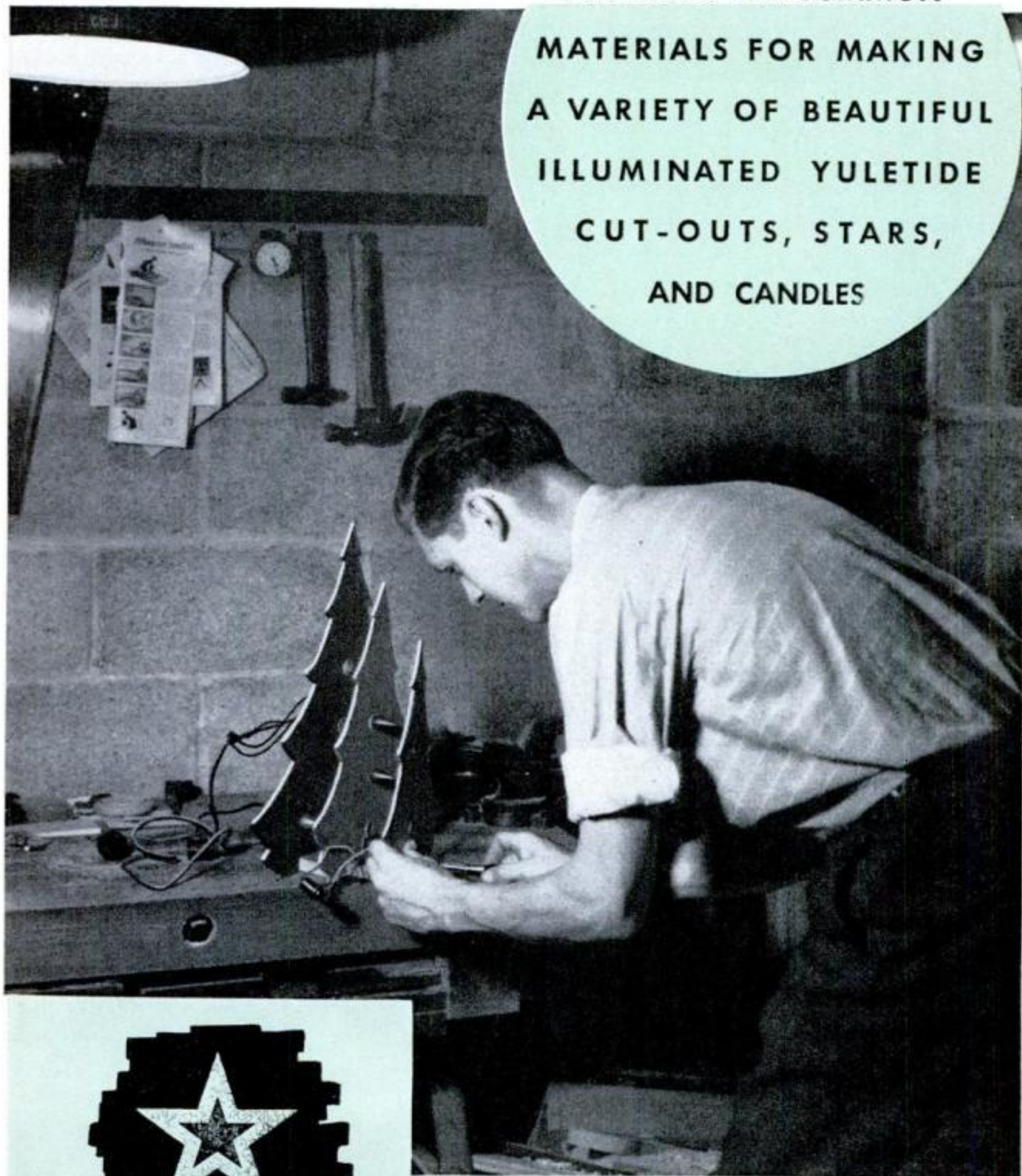


GIANT TRANSLUCENT CANDLES

Giant candles, stars, and silhouette trees combine to present a challenging Yuletide picture. One way to construct translucent candles is shown above. Yellow and blue lamps give the appearance of a flame on top



INGENIOUS WAYS TO USE COMMON MATERIALS FOR MAKING A VARIETY OF BEAUTIFUL ILLUMINATED YULETIDE CUT-OUTS, STARS, AND CANDLES



LOOK AROUND YOU FOR MATERIALS TO USE

Many materials may be used, including composition board, crinkled aluminum foil for covering lighted surfaces, festoons of colored lamps, laurel or evergreen roping, glass, plastics, colored cellulose wrapping material, fabrics, and the new so-called "projector" lamps. At left is a star covered with crinkled aluminum foil. Translucent stars are made in the form of a star-shaped box and covered with tracing cloth or shellacked muslin. A lamp is placed inside

Miniature Cottage

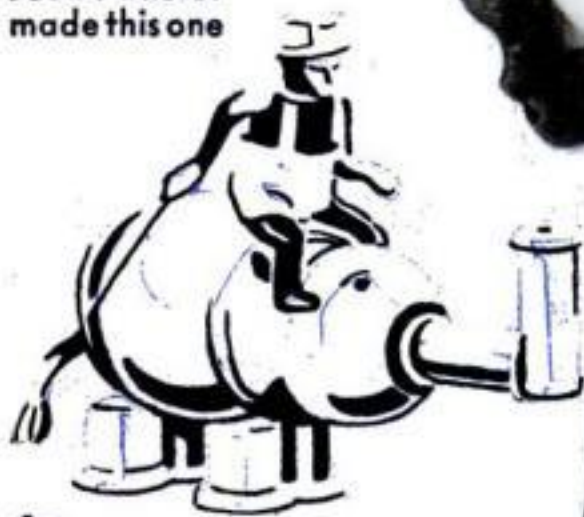
A one-room cottage won the first prize for Mrs. Luna Mae Fletcher. The outside walls are enameled white and the roof is red. The flowers in the front yard are made from crêpe paper



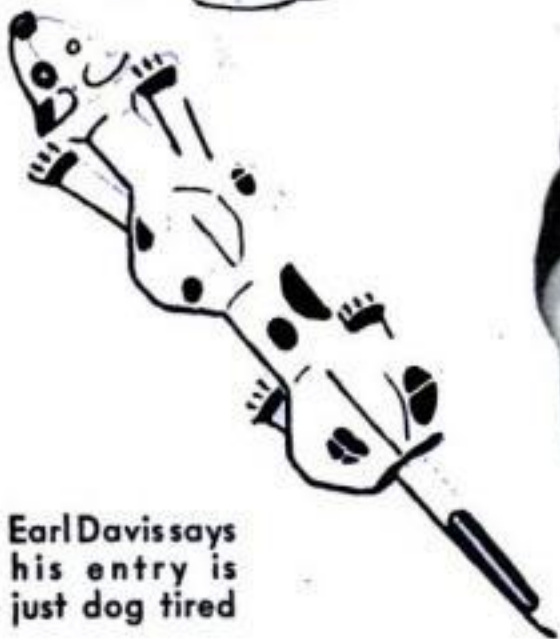
Telephone devised by Frank Longcamp, winner of a \$1 prize

The dancing horse, made by William Rybak, performs all sorts of antics when the board, which is held or fastened to the table, is vibrated by tapping it

Jean Fansler made this one



Earl Davissays his entry is just dog tired



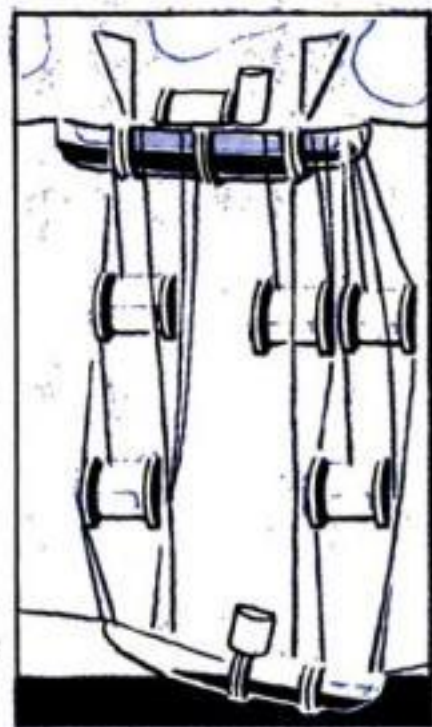
Wins Spool Contest

MOST of the entries submitted in our recent spool contest (see P.S.M., Sept. '39, p. 153) were made by men and boys, but it took a woman to design the most outstanding novelty. Mrs. Luna Mae Fletcher, of Newberry, Fla., fashioned an attractive miniature cottage from ordinary thread spools and won first prize of \$25. Photographs of the three principal prize-winning projects and sketches of those winning \$1 prizes appear on this and the preceding page.

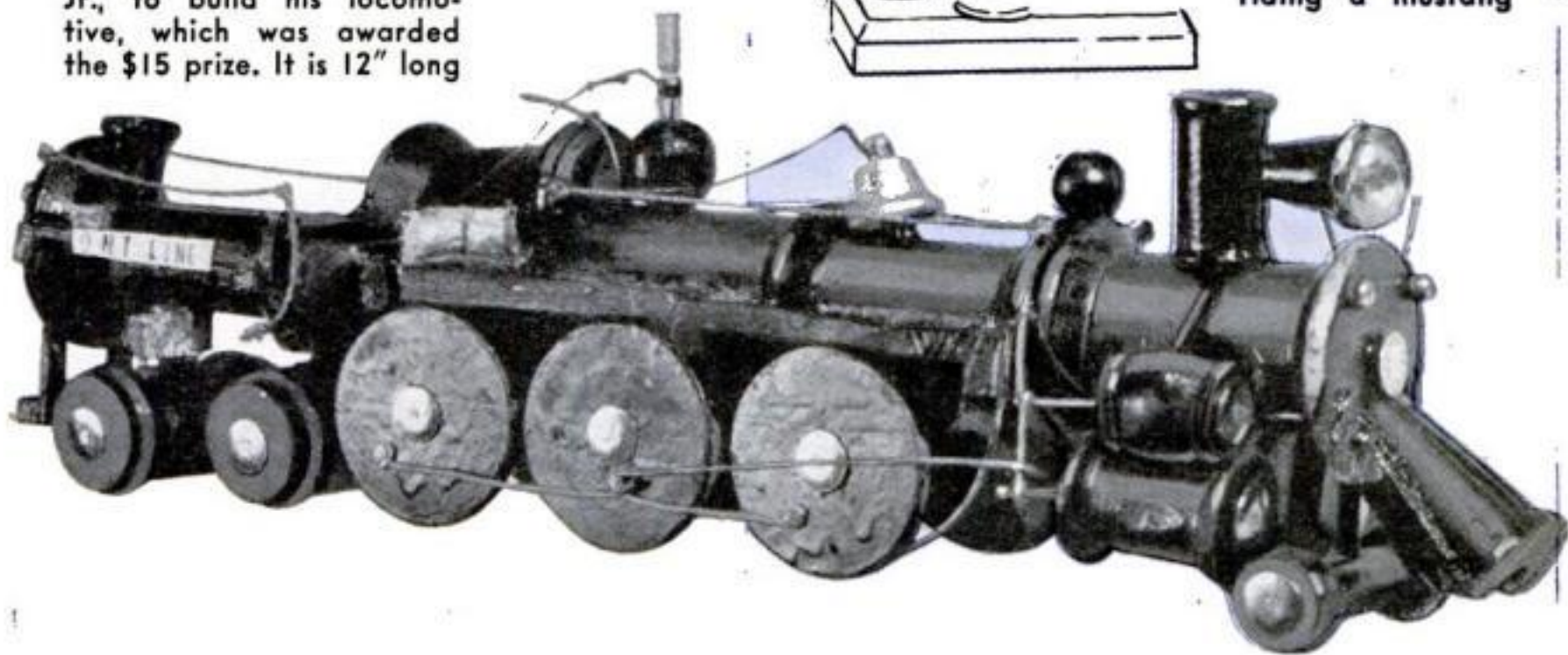
Dolls, toy automobiles and tractors, lamps, toy furniture, picture frames, caricatures, weird animals, and models of famous cartoon characters were among the many entries received. Some were humorous, such as the dog sketched on the facing page, which was entitled, "I'm just dog tired."

Ten different spool sizes were used by Jack Cloman, Jr., to build his locomotive, which was awarded the \$15 prize. It is 12" long

The raising of the "Squalus" by the submarine tender "Falcon" was selected by Robert Crowell for the subject of his novel spool picture



Jack Parry designed this cowboy riding a mustang



Awards for Best Spool Novelties

FIRST PRIZE, \$25

Mrs. Luna Mae Fletcher, Newberry, Fla.

SECOND PRIZE \$15

Jack Cloman, Jr., Richmond, Va.

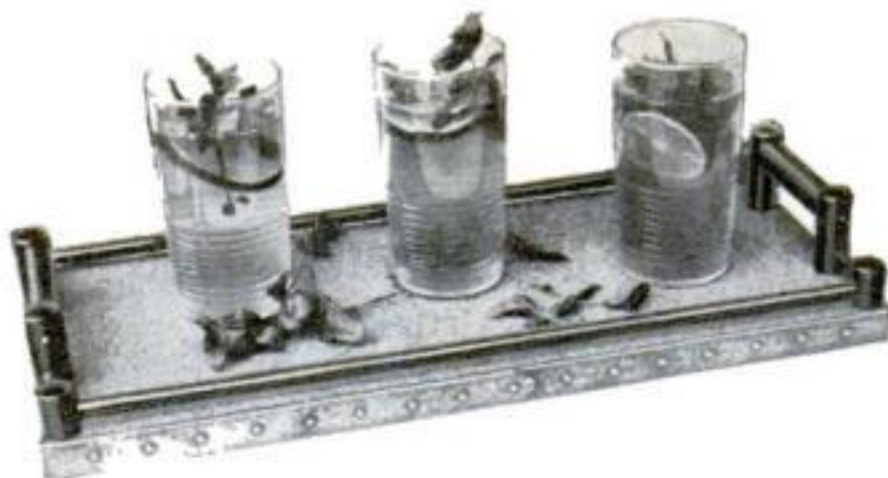
THIRD PRIZE, \$5

William Rybak, Cleveland, Ohio

\$1 PRIZES

Robert J. Crowell, Marblehead, Mass.; Earl Davis, Ogden, Utah; Jean Fansler, Catonsville,

Md.; Frank Longcamp, Aurora, Ind.; Jack Parry, Drumheller, Alta., Canada.



Cork-Faced Cocktail Tray Trimmed with Copper

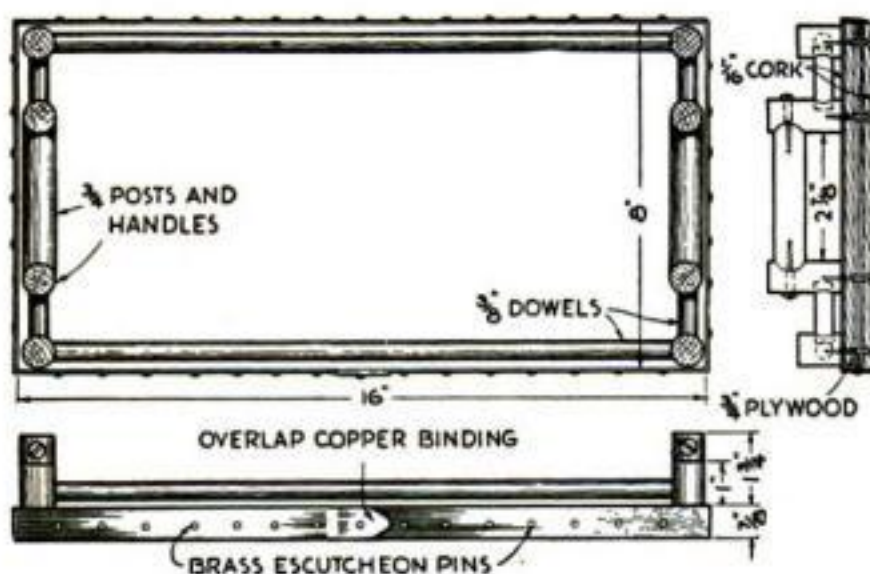
CORK, metal, and lacquered wood are combined in this attractive cocktail tray. The base is $\frac{3}{4}$ " by 8" by 16" plywood, to which a sheet of $\frac{1}{16}$ " thick cork is glued with waterproof casein glue. The cork can be obtained at almost any automobile accessory store. The posts, rails, and handles are cut from dowels. Posts and rails are finished with bright red brushing lacquer, the handles with black lacquer.

The edge of the tray is decorated with a strip of 20-gauge sheet copper $\frac{3}{4}$ " wide and 49" long. Holes are drilled through the copper 1" apart, and the band is applied with $\frac{5}{8}$ " No. 14 brass escutcheon pins. The copper is given a polished finish.

The handle and rail posts are attached with countersunk screws from underneath, and another sheet of $\frac{1}{16}$ " cork is glued to the bottom of the tray. A set of eight coasters $3\frac{1}{2}$ " square may be cut from $\frac{1}{8}$ " thick cork to complete the set, if desired.

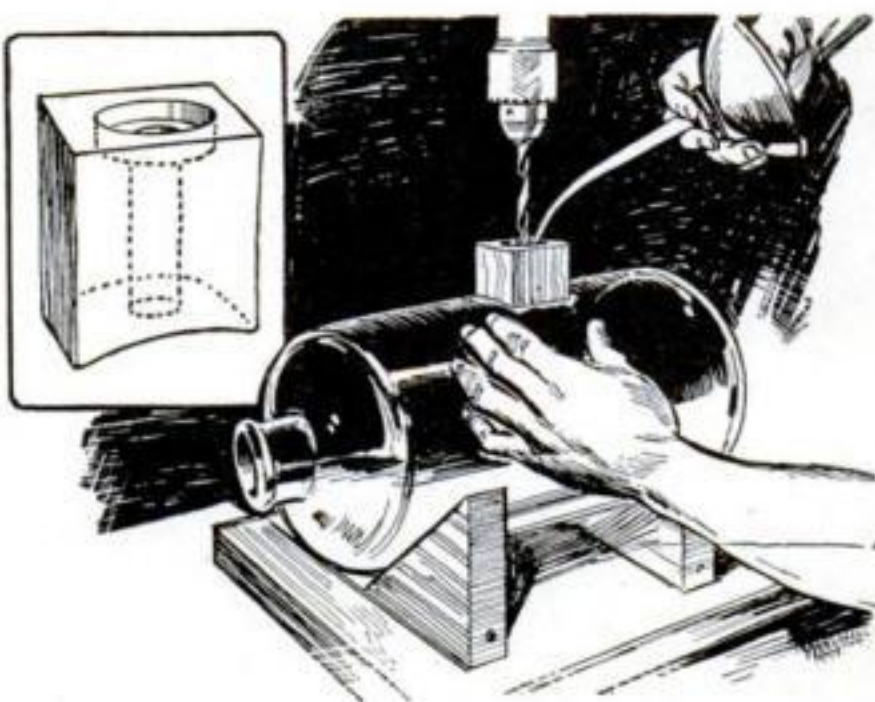


At right, applying copper band to the edge. Below, how tray is made



Bottle Drilled with Aid of Wooden Bushing

GLASS bottles and jars can be drilled more easily if a wood bushing is made and cemented on with liquid solder to steady the drill. The counterbored section of the bushing acts as a reservoir for holding an ample supply of turpentine. If a carbon-steel drill is used, it pays to heat the point to a bright red, dip it in sulphur, and then quench it quickly.—ARMEN TASHJIAN.



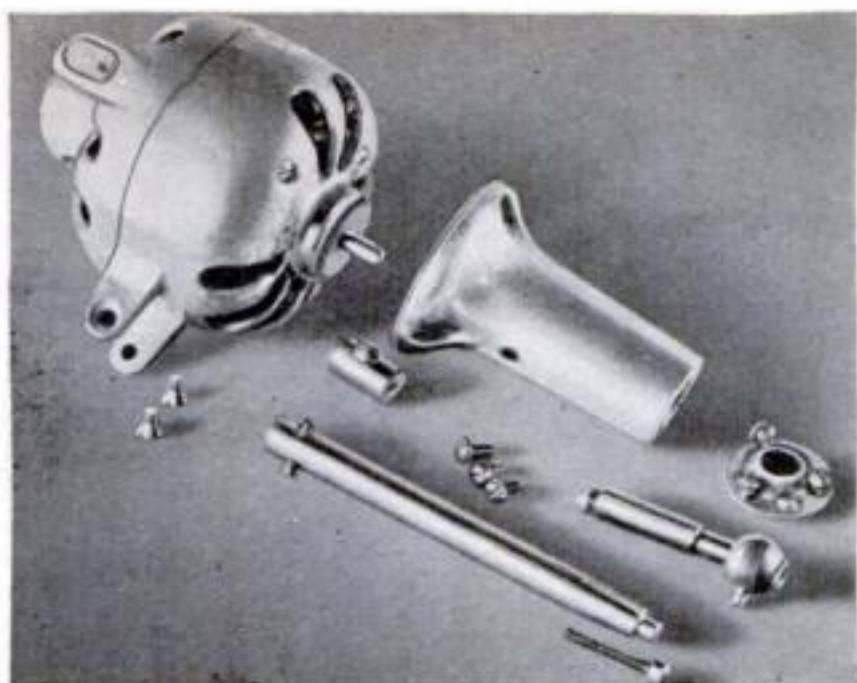
The bushing guides the drill and holds turpentine

Desk Lamp Lights a Lathe

A DESK lamp of the type illustrated is well suited for illuminating work at the wood lathe. It can be placed on a shelf in back of the lathe or fastened to the wall. A 60-watt bulb furnishes ample light.



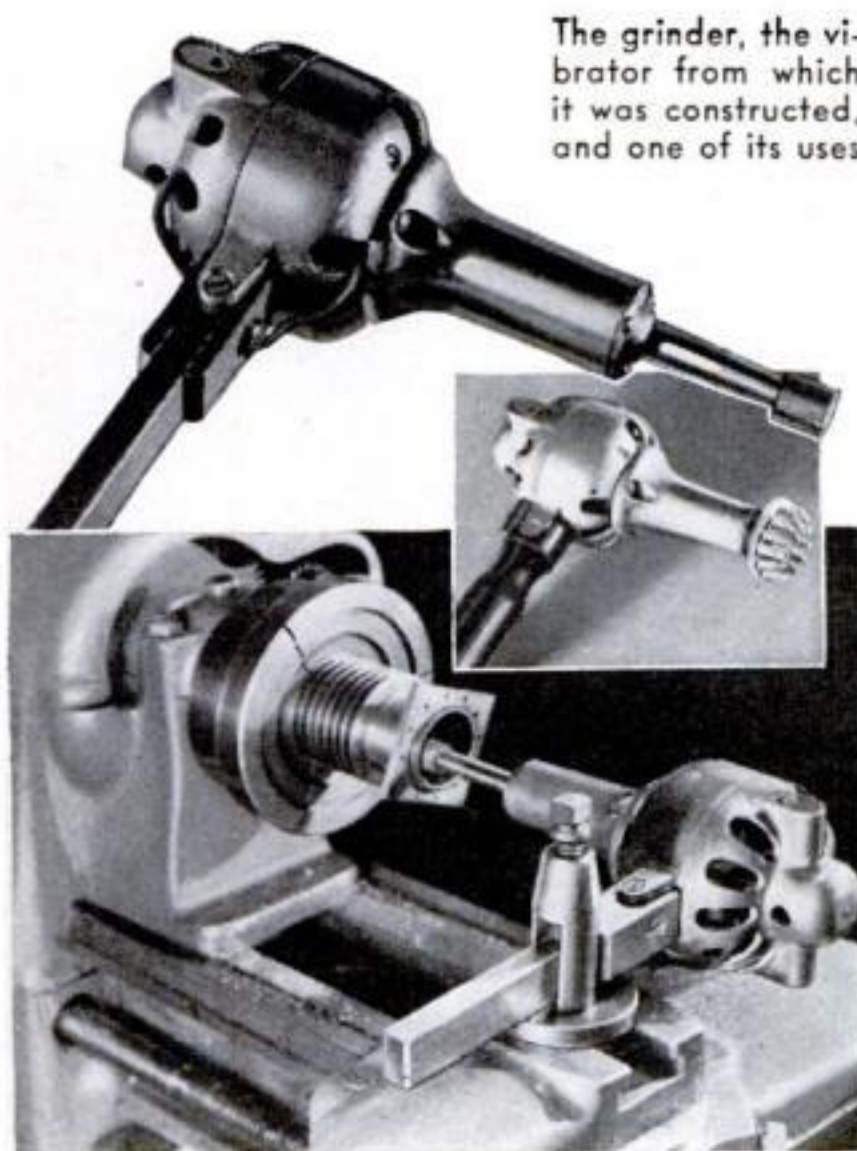
Placed on a shelf or fastened to the wall, the desk lamp illuminates the work without any glare



Tool-Post Grinder Built from Old Vibrator

MADE from an old vibrator of the type illustrated below, this tool-post grinder has many uses in the lathe. It may be used for such work as truing hardened centers, sharpening milling centers, and finishing the bore of model cylinders.

The photograph above shows the parts of the vibrator and, in the foreground, the new grinding-wheel shaft that was made to replace the old, shorter shaft. A shank for the tool post was fitted in place of the original handle. The view at the bottom of the page shows the little grinder smoothing the bore of a model gas-engine cylinder, which is held in the collet step chuck.—C. W.



The grinder, the vibrator from which it was constructed, and one of its uses

Long Mechanical Fingers Pick Up Litter

WITH these long-handled mechanical fingers one may pick up, without stooping, any odds and ends that litter the floors and are a menace to the vacuum sweeper. The rubber fingers grip anything from pins and string to cloth and marbles.

The flexible arms are made from 12" lengths of 24-gauge sheet iron, folded to measure $\frac{5}{8}$ " in width and attached to a broom handle or other pole of suitable length. Heavy rubber suction cups are bolted to the ends of the arms, and the bottom edges of the cups are ground to a sharp edge. A lightweight push spring, fastened as shown, holds the flexible arms in an opened position. A slight grip of the hand on the triggerlike handle easily operates the wire clamp attached to one of the arms, thus closing the cups.—D. C. BARE.



Squeezing the grip closes the rubber cups at the bottom

Objects on the floor or underneath furniture and radiators are easily picked up with this device

Safety Pins Cut Off for Use as Price-Ticket Holders

NEAT price-ticket holders can be made in a jiffy by the simple expedient of cutting off the catches of safety pins and using the pointed parts. The cards are held by inserting them in the springlike coils, as indicated in the sketch at right.—W. S.



Choosing Tools

FOR YOUR HOME WORKSHOP

WHAT woodworking tools should a home shop have? That's a touchy question, for so much depends on the user and his hobby. Some authorities even say there is no basic list. However, there certainly are some tools that are needed by any average home mechanic, and these are mentioned in the following questions and answers:

What is the minimum equipment?

For real accomplishment, with a reasonable expenditure of time and labor, the following tools are necessary:

BORING

Auger bits, $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ "
Countersink
Ratchet brace, with 10" sweep
Twist drills, set of 8

CLAMPING

Pliers, with wire cutter, 8"
Screw drivers: 4", 10"
Screw-driver bit
Pipe wrench, 10"
Clamp-on bench or saw-horse vise

CUTTING

Coping saw
Crosscut saw, 26", 8-point
Pocketknife
Tin snips, 10"

SHAVING

Chisels: socket firmer, $\frac{1}{2}$ ", 1"
Cold chisel, $\frac{3}{8}$ "
Jack plane

HAMMERING

Claw hammer, 16 oz.
Nail set, $\frac{1}{8}$ "

MARKING

Center punch

MEASURING

Rule, 6', folding or roll-up
Squares: 12" combination and steel framing square

PAINTING

Brushes: 3" flat, chisel edge; 1" oval trim

FILING

Files: 6" slim taper; 12" half-round bastard; 6" mill, second cut

MISCELLANEOUS

Combination oilstone
Glass cutter

What additional tools are needed for a fairly complete list?

The group that follows is a representative selection.

BORING

Auger bits: $\frac{7}{16}$ ", $\frac{9}{16}$ ", $\frac{1}{2}$ ", 1"
Drill, hand or breast
Expansive bit

CLAMPING

Bar clamps, for wood bars, 1 pr.
C-clamps, 6", 1 pr.
Hand screws with steel screws, 12", 1 pr.
Machinist's vise, 3"
Monkey wrench, 10"
Saw vise
Screw driver, spiral ratchet, 19"

CUTTING

Back saw, 12"
Cutting pliers, end and diagonal, 8"
Hack saw, adjustable
Hand saws: rip, 26", 5-point; panel, 20" cross-cut, 11-point; compass, with keyhole and metal-cutting blades
Razor-blade holder

HAMMERING

Rubber mallet
Tack hammer

GRINDING

Bench hand grinder

MARKING

Marking gauge
Scriber

MEASURING

Bevel square, sliding T-head
Calipers, inside, outside
Prick punch
Spirit level, 24"
Wing dividers

PAINTING

Varnish brushes, $1\frac{1}{2}$ ", $2\frac{1}{2}$ "

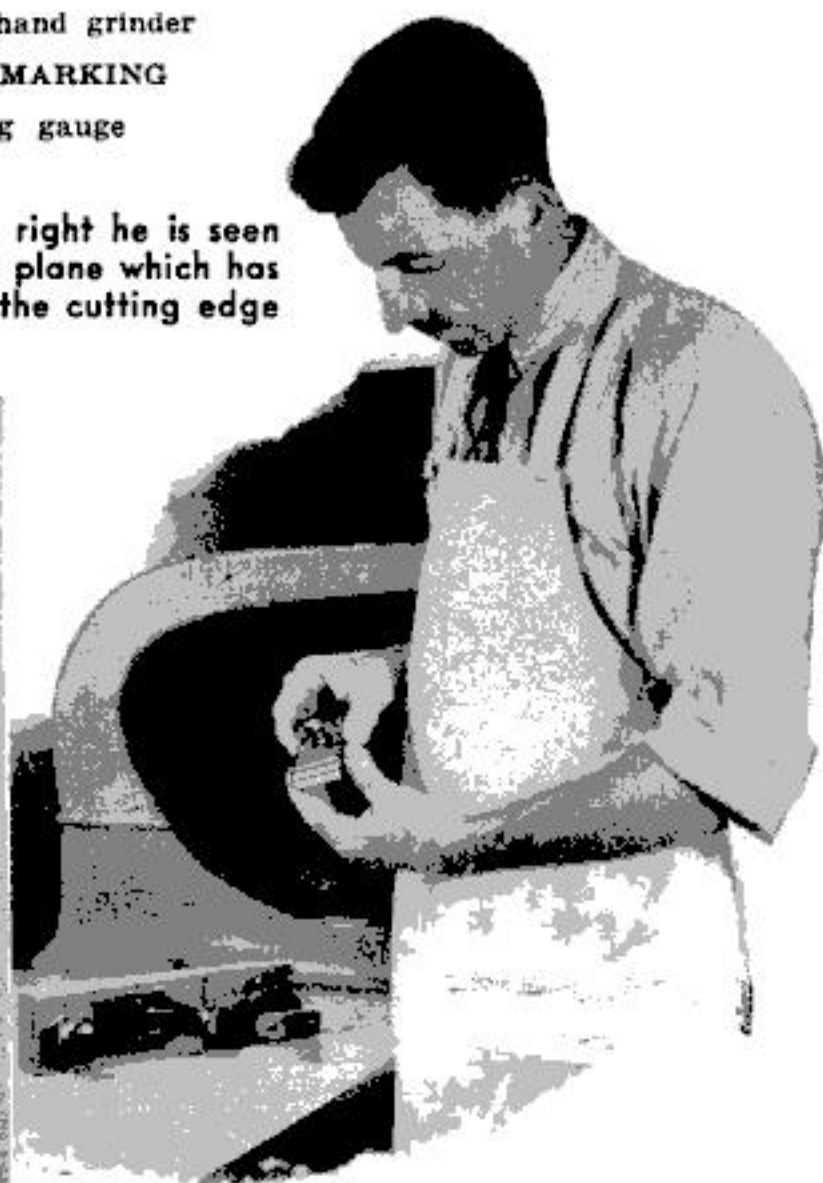
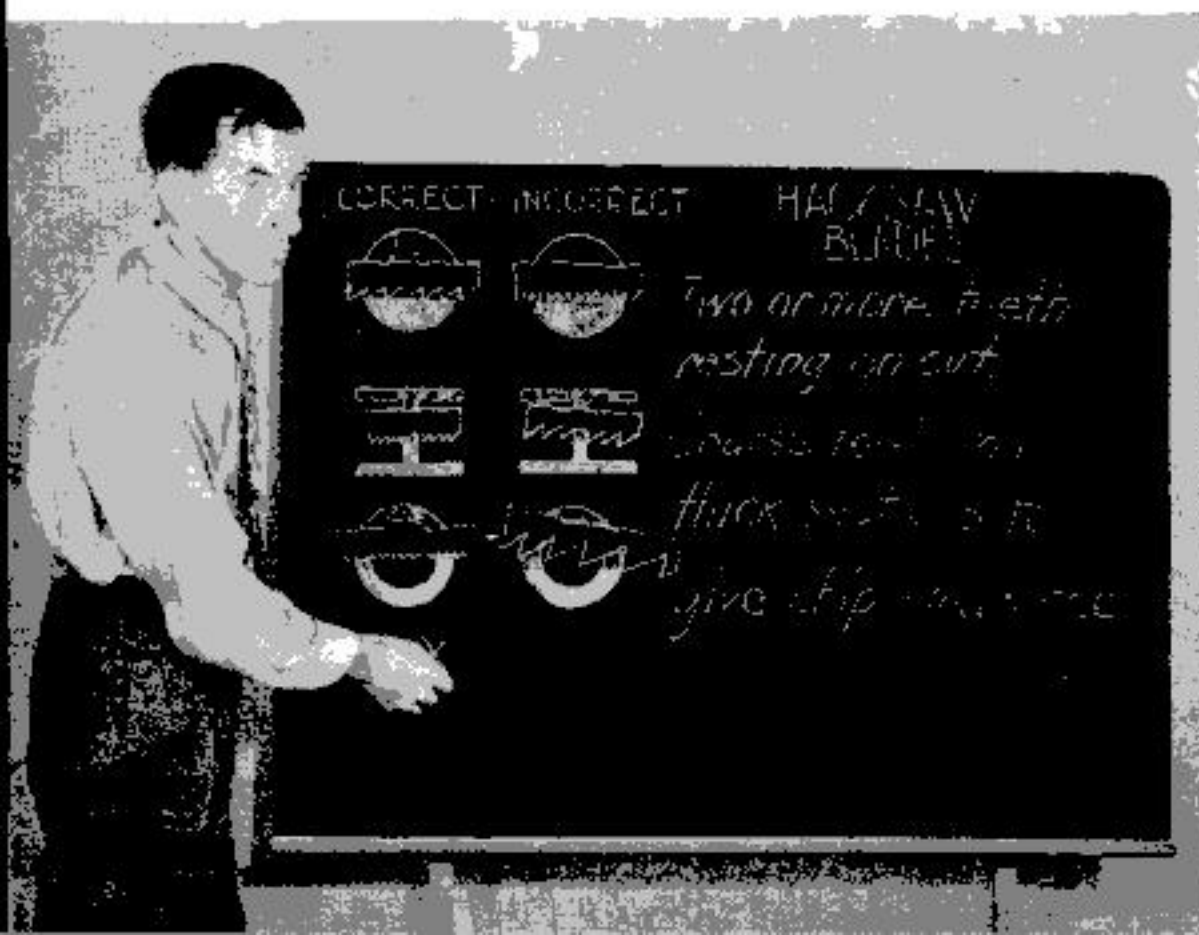
SHAVING

Block plane
Cabinet scraper (blade), 3" by 5"
Chisels: socket firmer, $\frac{1}{8}$ ", $\frac{3}{8}$ ", $1\frac{1}{2}$ "
Cold chisels, $\frac{1}{4}$ ", $\frac{7}{8}$ "
Fore plane
Gouges, inside bevel, $\frac{3}{8}$ ", $\frac{1}{2}$ "
Half hatchet
Rabbit plane, $8\frac{1}{2}$ "
Smoothing plane

MISCELLANEOUS

Burnisher for scraper
File card
Slip stone for gouges
Gluepot and brush
Putty knife
Saw set
Soldering iron

Below, a chalk talk by Mr. Love on sawing metal. At the right he is seen with his pet smoothing plane—a so-called "Gage patent" plane which has a rigid chip iron that can be adjusted to within 0.01" of the cutting edge



By
**EDWIN M.
LOVE**

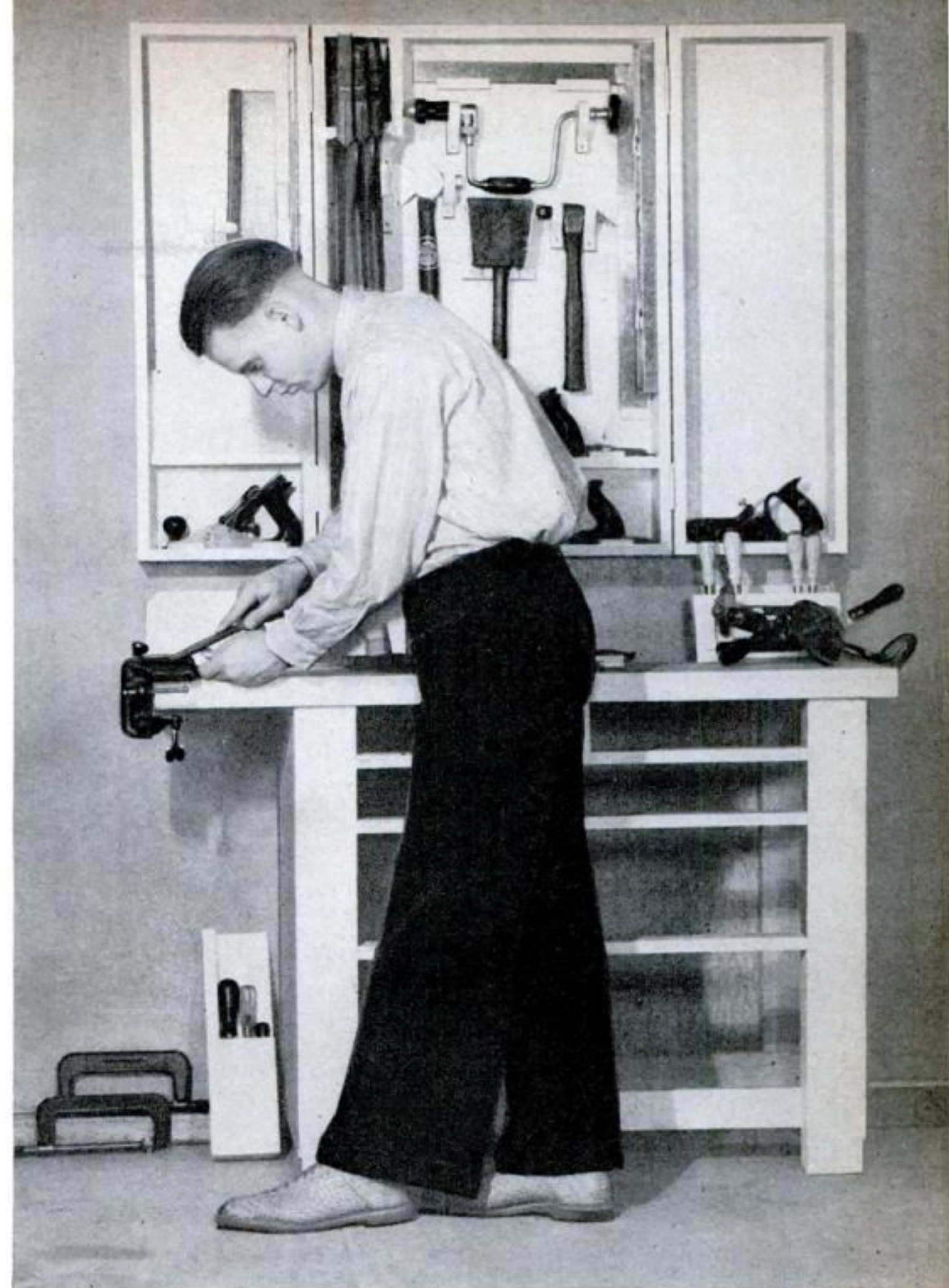
Wouldn't this assortment serve for a variety of work?

It is good for several hobbies, such as home repairs, building garden equipment and household furniture, erecting stage sets, doing pattern making. Many of these tools are useful in ship modeling.

Ship modelers need special tools, don't they?

A few inexpensive ones. A set of small carving chisels is useful, but they can be made at home from old hack-saw blades, clock springs, and umbrella ribs. The writer made up twenty-one in about six hours. Here is a handy assortment of tools for this fascinating hobby:

Awl, brad
Brace, wood-boring
Cabinet scraper, hook style
Carving tools, small set
Clamps: Several small C-clamps; 12" hand screw; spring wooden clothespins shaped to suit
Crochet hook, small
Drills: Assorted, Nos. 80 to 42; a set from 1/16" to 1/4"
Embroidery scissors
Files: Half-round bastard, 8"; needle, 3-sided, round, knife; rattle
Hammers: Claw; tack
Nail set, 1/32"
Oil, can of sewing-machine
Oilstone, combination
Pin vise
Planes: Small block; jack
Pliers: 5" diagonal cutters; flat-nose; round-nose



WE ADD A TOOL CABINET TO OUR \$15-A-MONTH BUDGET SHOP

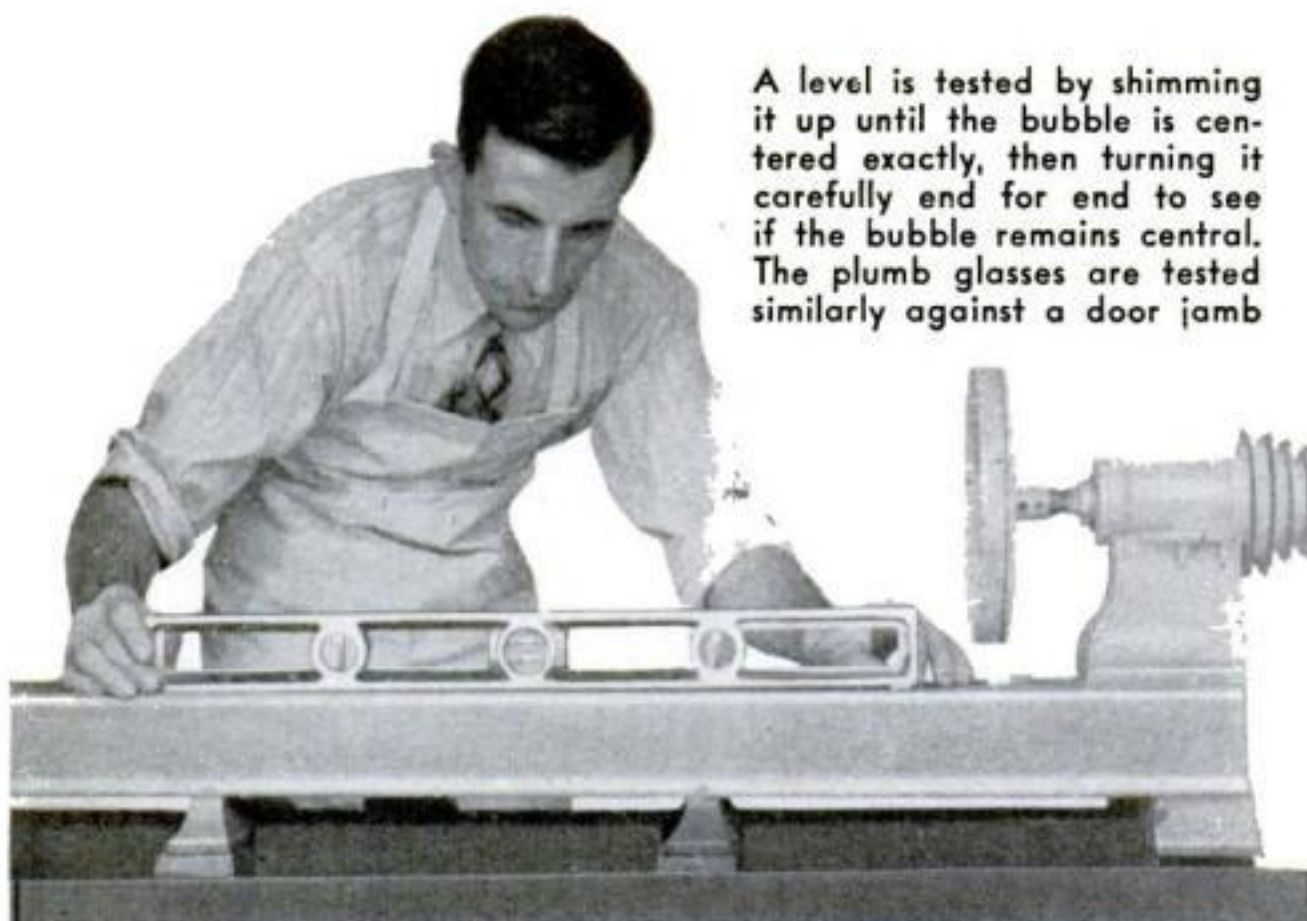
The bench now has its drawer rails, and a tool cabinet is being built. With a budgeted expenditure of \$15 monthly, all the more essential wood-working tools mentioned in this article will be paid for by next month

Pocketknife
Reamer, wood, 4", tapering 1/8" to 3/8"
Rule, 2' folding
Saws: Back, 8"; fret, 12"; jeweler's hack saw; larger saws, if desired
Soldering iron, preferably electric
Spokeshave
Straightedge, 3', preferably metal
Tin snips, 10"
Tweezers
Vise, small, machinist's type

How should tools be chosen as to quality?

There is little chance to judge materials. Steels, whether good or otherwise, look much alike. A high-priced tool probably is better than a cheaper one, but the best safeguard is to buy standard brands. Reputable manufacturers offer tools of various prices, but all give satisfactory service. Since the home worker is not especially concerned with speed, he can use a shorter saw, and

PART II OF A NEW SERIES FOR BEGINNERS



A level is tested by shimming it up until the bubble is centered exactly, then turning it carefully end for end to see if the bubble remains central. The plumb glasses are tested similarly against a door jamb

teur, as the bit, popping out when it slips from a screw, may break the glass in a door being hinged.

What about planes, chisels, and bits?

A jack plane is the roughing plane. It can be used for most work, but its short length makes it unhandy for straightening long edges. A fore plane, being longer, works better, and the jointer is still better, but is rather expensive. For fine surfaces the smoothing plane is

one less highly polished, for example, than the journeyman might choose.

What features should be looked for in tools of equal quality?

Balance is one thing; a hammer should feel right in the hand. Edged claws meeting at a point enable a fine hammer to draw a brad or even a headless nail. A coarse crosscut saw can be used temporarily for ripping, but a rip saw is far superior. For fine cutting, as in making tenons, a back saw is the thing. A spiral screw driver works faster than a solid one. Some have springs that extend the bit automatically, but this may be a disadvantage for an ama-

best, being sharpened for the purpose. As it is short, it will work down on a board that is sprung lengthwise, where a longer plane might skip places. The block plane has a low-angle cutter that smooths end grain.

Socket-firmer chisels have sockets for the handles, and will stand much abuse, while tang chisels fit into holes in the handles, as in carving gouges. Short "butt" chisels are suitable for the home mechanic.

Auger bits are right for general work. Standard twist drills cost ten cents up and cut accurately in wood or metal, but cheap sets of eight or more drills selling for about a quarter will do for most wood drilling.

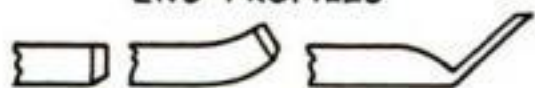
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MODEL MAKER'S CARVING TOOLS

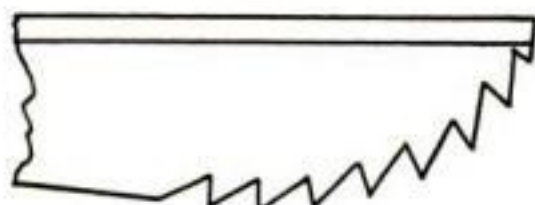
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END PROFILES



SIDE PROFILES



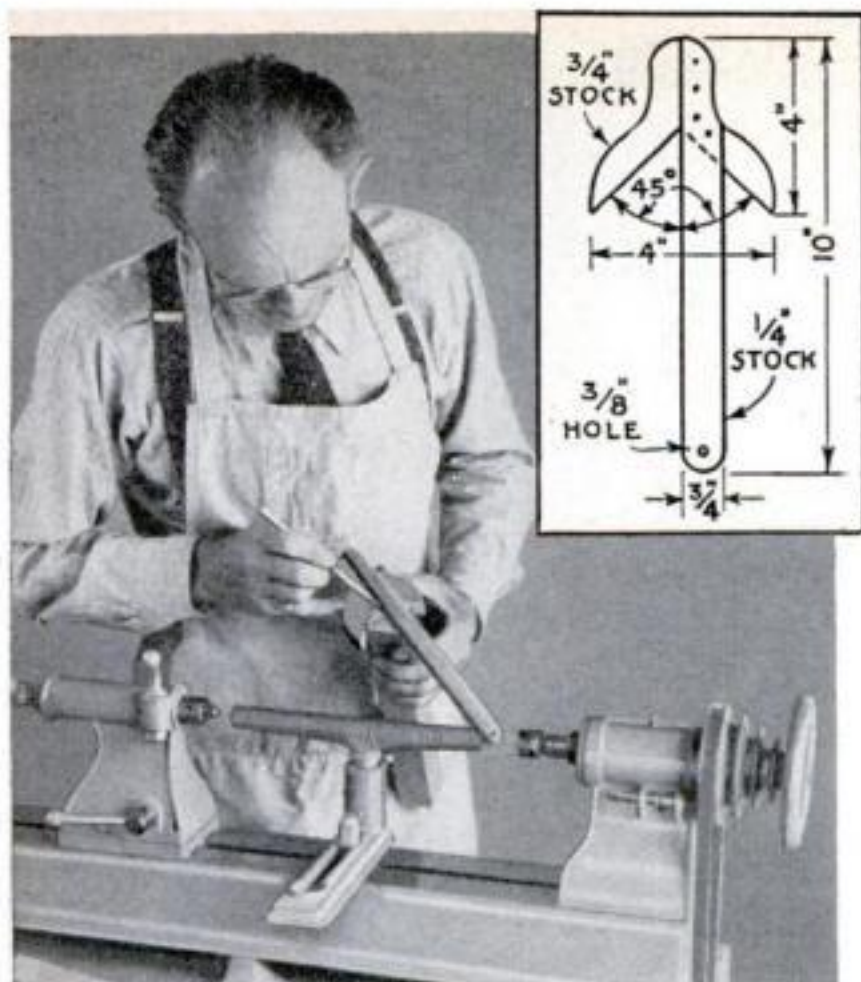
SCORING SAW

Various cutting shapes and, at right, a set of homemade tools

Materials: Umbrella ribs, hack-saw blades, handles. Heat steel red-hot to soften. Flatten umbrella ribs while hot, and file to shape. Each shape should be made in duplicate, one with outside, the other with inside bevel. Harden by heating red-hot and quenching in water.



POPULAR SCIENCE MONTHLY SHOP DATA FILE

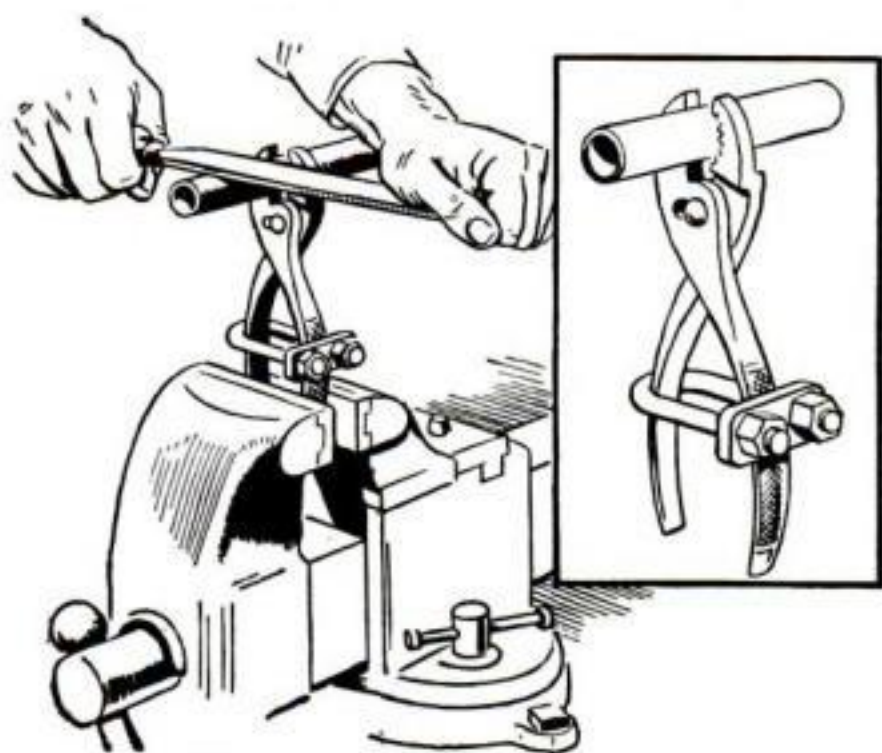


Homemade Tool Locates Wood-Turning Centers

WOOD-TURNING centers on round or square work can be located quickly with a centering tool made from hardwood as illustrated. The blade and handle are glued and nailed together, after which the tool is given a coat of linseed oil.—F. H.

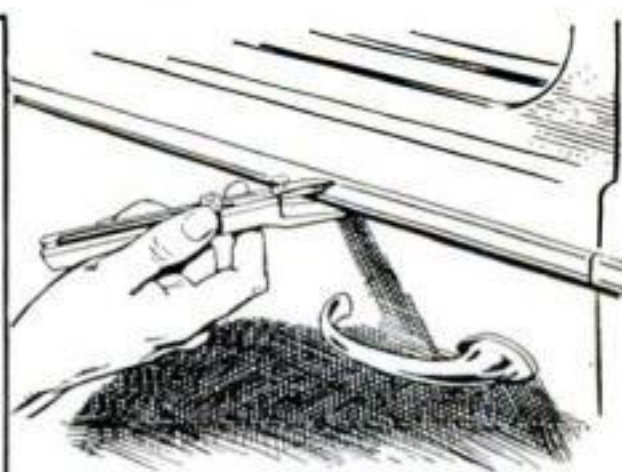
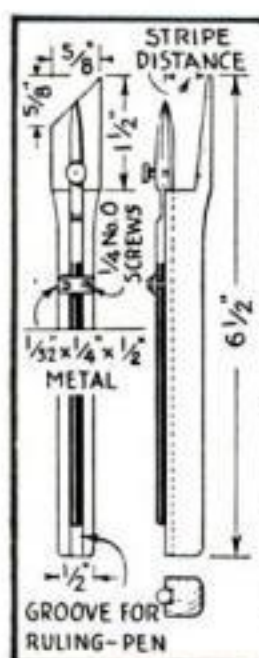
Pliers Serve as a Vise for Small Round Work

A CLAMP or vise for small round work can be improvised from a pair of slip-joint or gas pliers. The handles of the pliers are fastened with a U-clamp of the type used to bind wire ropes together. The pliers can then be gripped in the vise or, for some kinds of work, held by hand.—WENDELL HAYS BAKER.



Holder Aids in Striping with a Ruling Pen

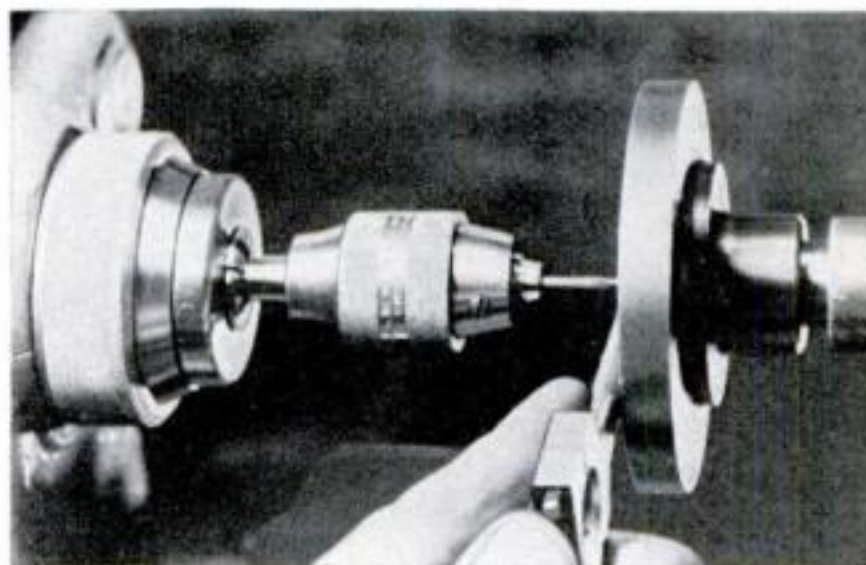
BY MAKING a holder as shown for a draftsman's ruling pen, it becomes a simple matter to touch up or stripe your car, models, or pieces of furniture. It takes less time to do the job than with a brush, and the stripes are more even.—GEORGE W. NIEDERMAIR.



As a guide in striping, a wooden holder is made for the ruling pen as shown at left. Above, using it to retouch striping on a car

Straight-Shank Drill Chuck Held in Lathe Collet

A SMALL drill chuck with a straight shank, which can be held in a collet, will save changing the collet attachment when drilling an occasional hole in the lathe.—C. W.



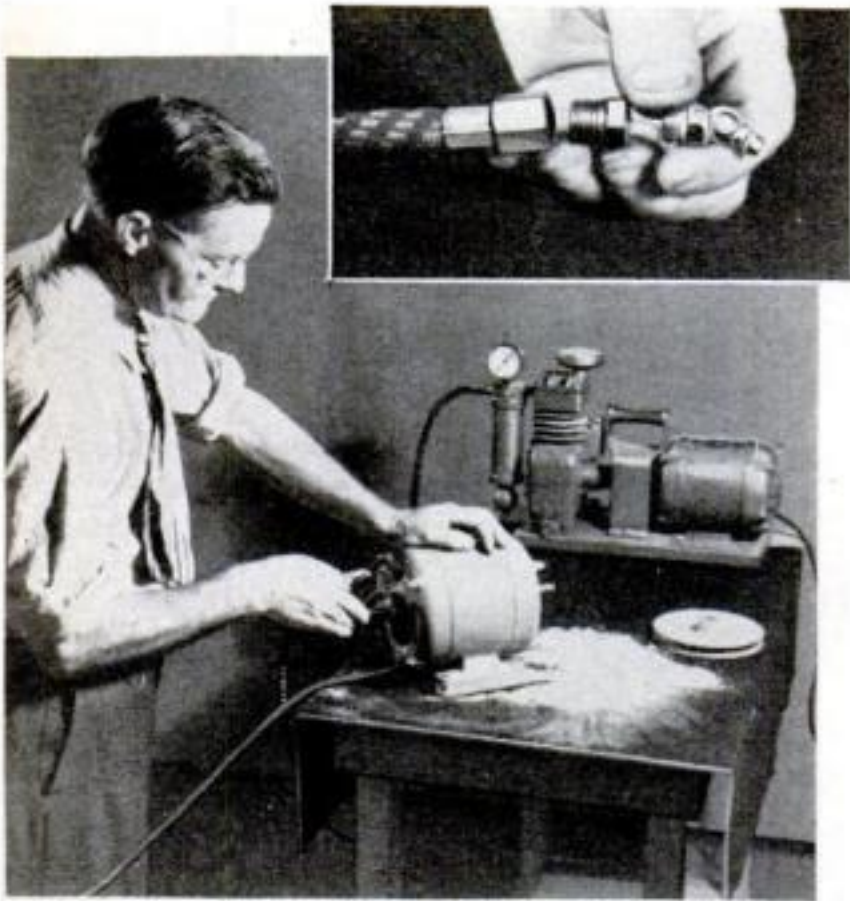
If a suitable drill chuck is at hand, holes can be drilled without removing the collet attachment

Making Hectograph Erasures

WHEN it is desired to erase a letter or a word in typewritten material that has been prepared for reproduction on a hectograph, it can be done easily by using a bit of cellulose mending tape. Cut the tape to fit and apply it over the mistake by catching the sticky side with the point of a pin and pressing the patch down firmly with another pin.—W. S. ICKLER.

Grease Fitting Provides Nozzle for Air Hose

SAWDUST can be quickly blown out of woodworking motors and machines with a compressor, especially if a nozzle is added by connecting a $\frac{1}{8}$ " 30-deg. push-type hydraulic grease fitting to the air hose with a $\frac{1}{8}$ " by $\frac{1}{4}$ " pipe-thread bushing. These fittings, which will fit a $\frac{1}{2}$ " hose, can be obtained at auto supply houses.



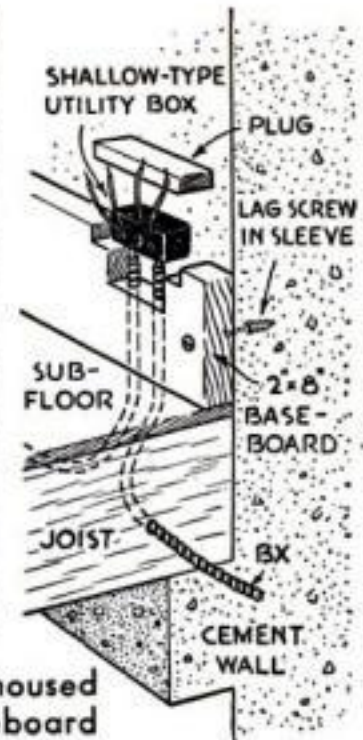
Blowing sawdust from a shop motor with an air-compressor hose to which a nozzle is attached

Fastening Loose Bristles in a Calcimine Brush

IF BRISTLES have a tendency to come out of a calcimine brush, hold the brush upright, push the bristles apart at the end of a row, insert a small funnel, and pour into it a generous amount of rubber cement or waterproof casein glue, thinned sufficiently to flow around and penetrate the "knots" or groups of bristles. Then push the funnel along to the other end. In a very bad case it may be necessary to unscrew the back of the brush and apply cement or glue to the ends of the knots. Soak the brush overnight and shake out the water before applying this treatment.—FRED STRICKLAND.

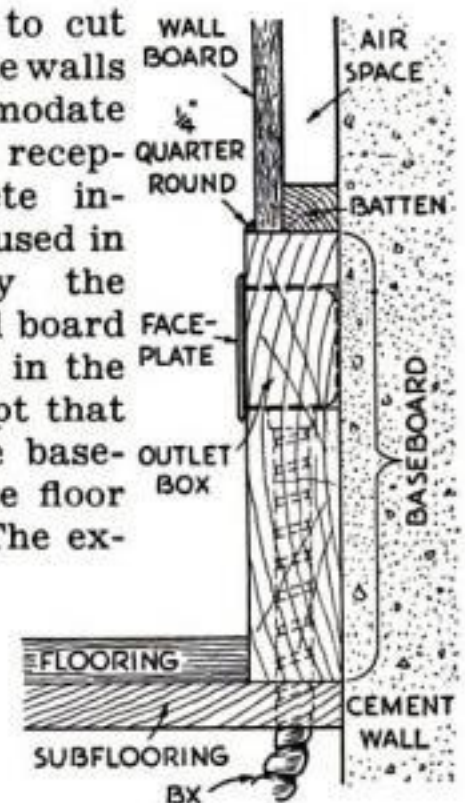


Outlets and wiring are housed directly in the thick baseboard



Baseboard with Outlets Used on Cement Walls

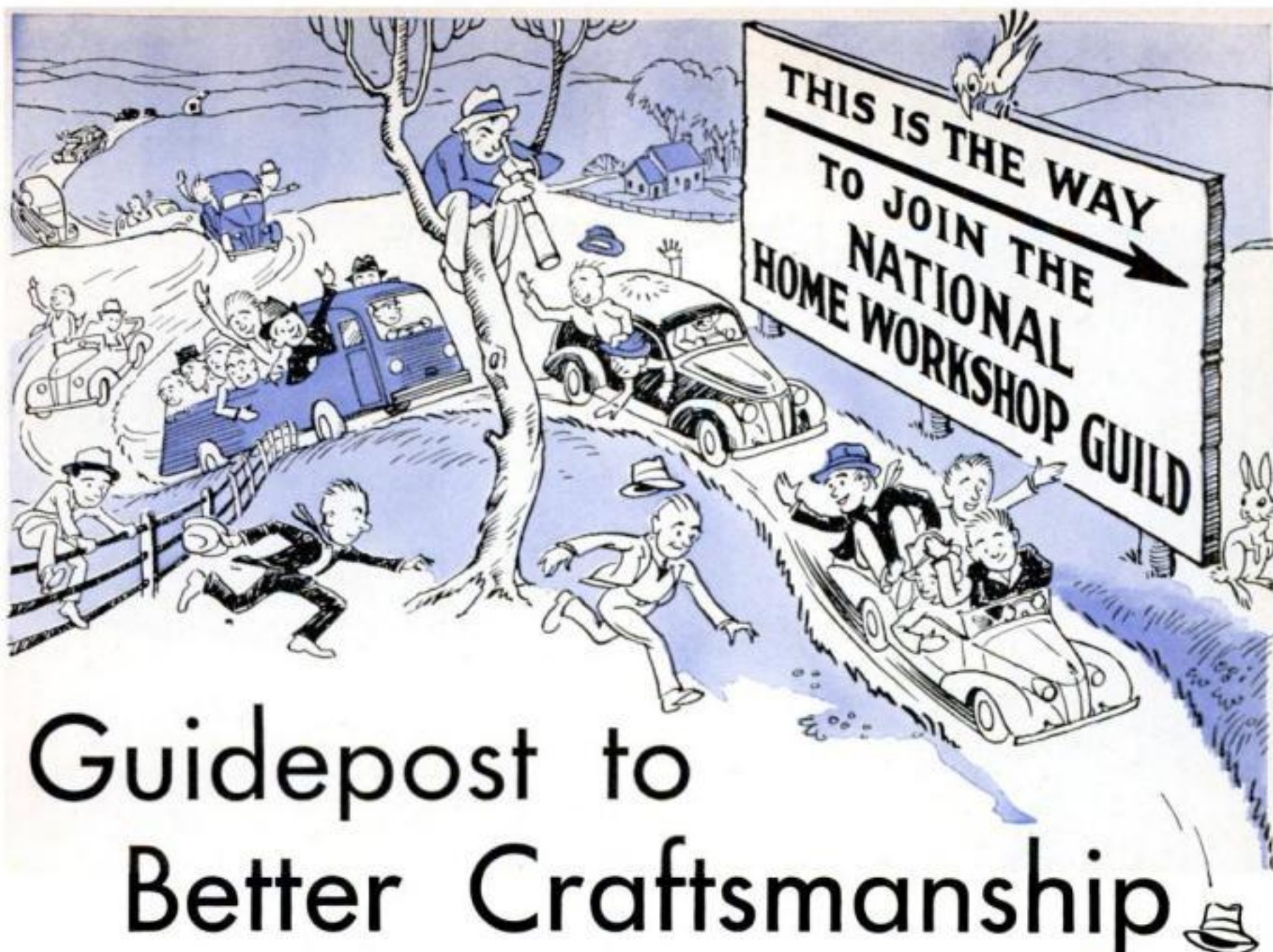
TO AVOID having to cut recesses into concrete walls in order to accommodate the wiring of plug receptacles, the complete installation can be housed in the baseboard by the method shown. Wall board can then be applied in the usual manner, except that the top edge of the baseboard instead of the floor serves as a base. The extra thickness of the baseboard allows the usual insulating air space between board and cement.



Penholder Improvised from a Pencil

WHEN a social letter has to be written, or a check or application blank filled out in ink and no fountain pen or ordinary penholder is at hand, a common pencil clip can be made to serve as a pen-nib holder. Push the clip to the top of the pencil and insert the nib under it, as shown.—S. W.





Guidepost to Better Craftsmanship

MORE than six years have passed since the National Homeworkshop Guild was organized. During that time thousands of craftsmen have discovered that their enjoyment of the home workshop hobby increases manyfold as soon as they join a home workshop club. Demonstrations, lectures, moving pictures, exhibitions, contests, and the like, which are a part of every club's programs, are planned with the thought of assisting members in their work. As a result, each annual home workshop exhibition held by a club reveals a definite advance over the preceding one. The projects are more varied and more expertly finished with respect to details.

If you are an amateur craftsman, you naturally desire to improve your craftsmanship—and the way to do that is to join a club. The progressive craftsman no longer works entirely by himself. Instead, he meets regularly with others enthused over the same hobby to learn more about it.

To participate in the benefits that affiliation with the Guild can give you, organize a home workshop club in your community now. Monthly bulletins containing a wealth of ideas and information, job sheets, and other literature are sent to each club without charge.

It's easy to start a home workshop club and, once formed, you will be surprised to find how many other persons will become in-

terested in it. To help you get started, the Guild has prepared a special three-page bulletin containing full instructions. This bulletin and an application blank will be sent gratis upon receipt of a large self-addressed, stamped envelope. There is no obligation attached to joining the Guild; all its services are free.

National Homeworkshop Guild
347 Fourth Avenue, New York

Please rush complete information on your free membership plan. I am anxious to join the Guild and believe that a home workshop club can be started in my community. For your use in sending this material, I am inclosing a large (legal size), self-addressed, stamped envelope.

Name.....

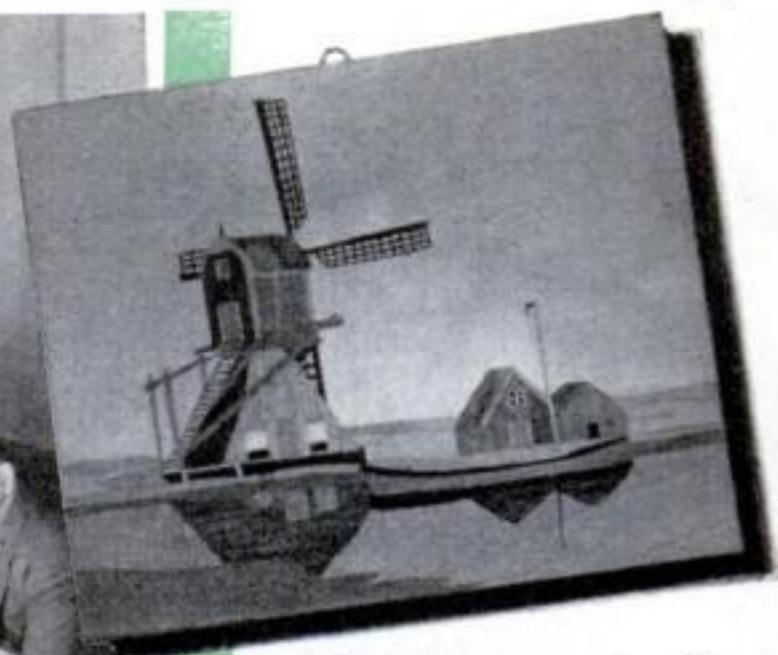
Address.....

City.....State.....

Guild Club Builds Workshop



Executive meeting of the Chicago Carvers and Craftsmen's Club. An extensive schedule of weekly sessions is arranged for the winter



Inlay picture made with colored woods by John W. Hough, secretary of the club shown at the left

program for the fall and winter. According to John W. Hough, secretary, "It is our hope to make our club a sort of central clearing house for all the Chicago clubs affiliated with the Guild. We are arranging programs for each meeting night. Power-tool demonstrations, veneer matching and in-

A CLUB workshop is being erected in Jackson, Mich., and it has cost the members of the Hillside Homeworkshop Club only \$1.25 to date. The shop will measure 15' by 24' when completed. To obtain the lumber, the men offered to raze a house in their spare time, and in this way they obtained the bulk of their materials free.

Secretary Clinton Smith reports: "None of our members can afford an entirely complete shop of his own, and we feel we can do more by having a club shop. We had some difficulty in getting started, but now everything is running smoothly. Twelve members joined recently."

This is a typical example of the enthusiasm with which home workshop club members are imbued. Hundreds of other clubs throughout the United States affiliated with the National Homeworkshop Guild are becoming increasingly active. Fellow townsmen are sitting up and taking notice.

The Chicago (Ill.) Carvers and Craftsmen's Club has undertaken an ambitious

inlay picture making, talks on lathe turning, and the like will be given. Moving pictures will be shown. We also hope to secure the coöperation of dealers in homecraft supplies in arranging an exhibit of tools and supplies to be placed in locked show cases. Our club is in an excellent location and we have a very full complement of workbenches and power tools."

Members of the United States Trust Company Homeworkshop Club, New York City, recently visited the woodworking shop of the Brooklyn Y. M. C. A. to see a demonstration of the use of power tools . . . Sales stamps are being saved by the Gem City Homeworkshop Club, Dayton, Ohio, and will be cashed for the benefit of the club's treasury. The coöperation of both the junior and senior Chambers of Commerce was obtained for helping with the club's toy projects . . . The Billings (Mont.) Homeworkshop Club expects to repair approximately 1,000 toys . . . Three pictures of the King and Queen of England were framed by the Preston (Ont., Canada) Homecraft Club and pre-

with Lumber from Razed House

sented to local schools. More than thirty members attended a picnic last fall. The Christmas toy quota has been doubled . . . Browning T. Baker spoke on cabinetmaking before the *Newton (Mass.)* Homecrafters Club.

Wendell T. Magoun, secretary of the King Philip Homeworkshop Club, *Rockland, Mass.*, writes: "Our membership is growing very rapidly. At present we have twenty-

four members, and several applications are ready to be voted upon. The club recently secured the services of Carl E. Vose, Frank Edwards, and John Sullivan from a Boston firm who gave a very instructive demonstration on the choice and application of paints and varnishes. Following this, they presented motion pictures of a trip through a modern paint factory. Albert Ewart explained tricks in making fake antiques and discussed methods of wood finishing."

One of the members of the Sohio Homeworkshop Club, *Cleveland, Ohio*, donated plywood for the construction of toys. Lloyd Speckman was appointed book reviewer, and Paul Alford was placed in charge of demonstrations. Adrian Roberts displayed rare woods he had collected on a trip to Florida. Edward H. L. Schaefer, secretary, is compiling a complete list of tools owned by the members.

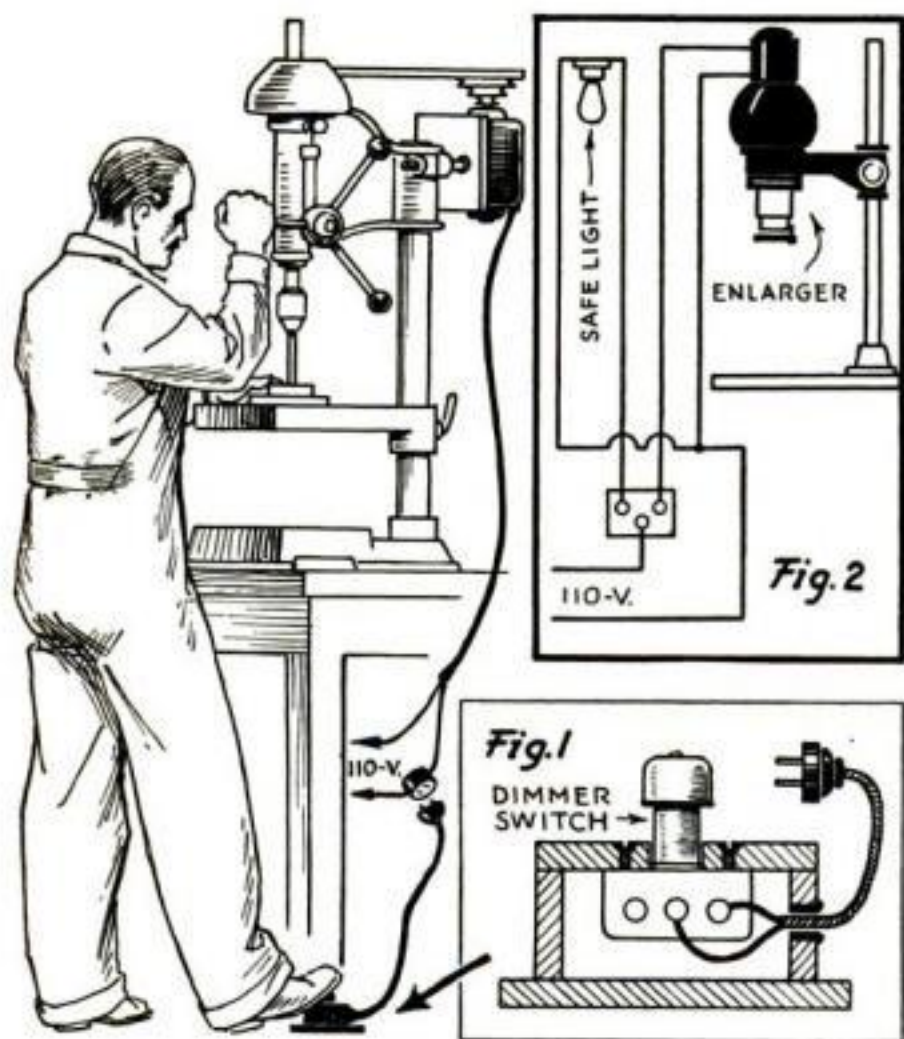
A recent meeting of the *Vicksburg (Miss.)* Homeworkshop Club was devoted to cutting wood for toy wagons to be given away at Christmas.



Charles H. Hunt, president of the Long Beach club, with one of his ship models



Exhibit of the Long Beach (Calif.) Homecraftsmen's Club in the municipal auditorium. A workshop was set up, and members made turnings and puzzles to give away to the thousands who attended



Foot Switch for Machines or Photo Printers

AN INEXPENSIVE automobile dimmer switch mounted in a small wooden box and wired as shown makes an excellent foot control for any small machine tool, especially a drill press. If a plug-and-socket arrangement is used as in Fig. 1, one switch will serve several tools. It also makes a good switch for a photo enlarger or contact printer, in which case, if wired as in Fig. 2, it will turn off the safe light when the white light is on. This is an advantage when focusing a dense negative.—J. M. BOWLES.

Spring Catch Holds Door Open Against Wall

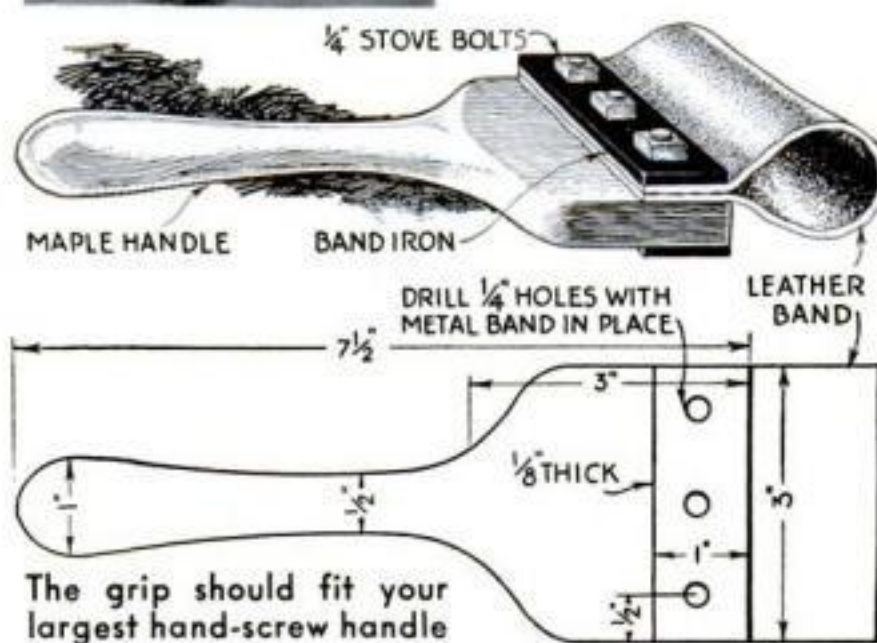
WHEN it is desired to hold a door open against a wall in a shop or any other place where appearances are not of great importance, one of the most convenient ways to do it is by using the type of outside, double-acting, bumper catch made for keeping a screen door tightly closed. The same device may also be used on yard gates, cooler doors, and the like to hold them shut.—W. L. KIRK.



Auxiliary Handle Tightens Hand Screws Quickly

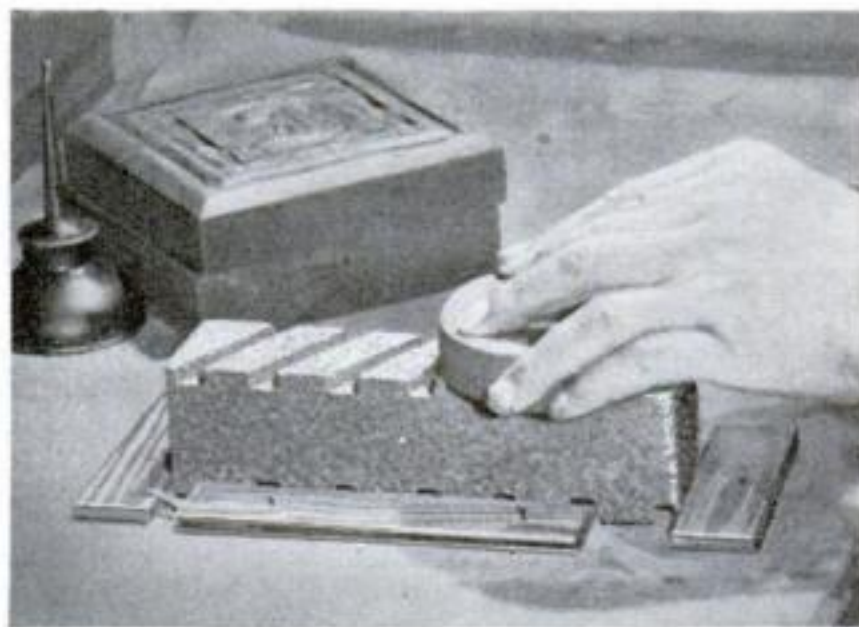
TIGHTENING hand screws requires little effort if an auxiliary handle is made as shown from maple or hickory. Select a strong, pliable piece of leather, such as old belting, for the grip.

If you have several hand screws with handles of different diameter, select one with the largest handle, wrap the leather snugly around it, and use that size.—E. C. H.



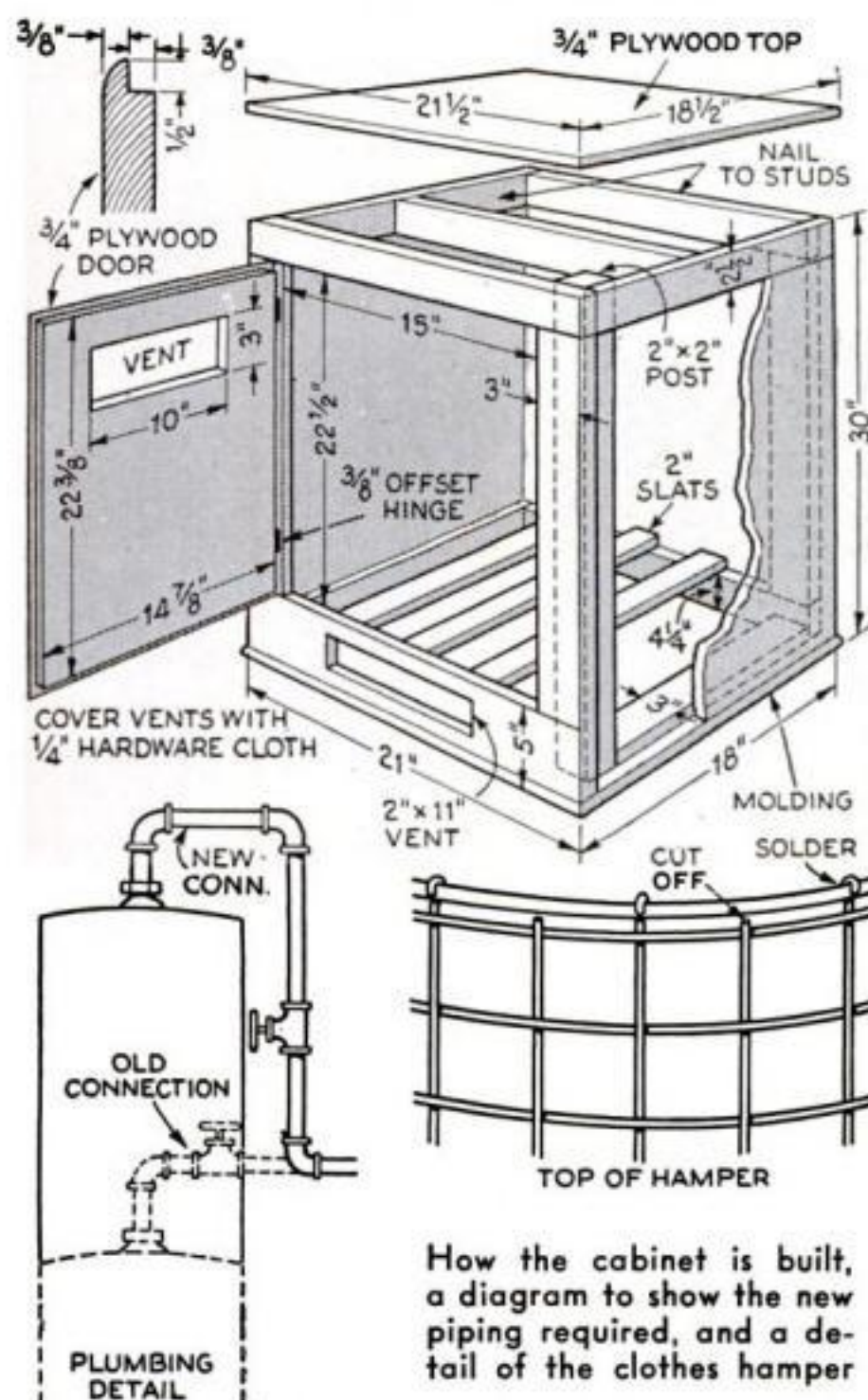
Worn Oilstone Trued Up on a Rubbing Brick

OILSTONES often become worn hollow in the center, but they can be trued up like new on a fluted rubbing brick or stone, if available. Take long, full strokes over the entire surface of the rubbing stone, as illustrated in the photograph below, and keep changing the position of the oilstone. The flutes of the rubbing stone should be kept wet during the operation.—A. S. J.



Clothes-Hamper Cabinet

BUILT UNDER
A WATER HEATER



How the cabinet is built, a diagram to show the new piping required, and a detail of the clothes hamper

MOST gas water heaters have considerable waste space above them, occupied only by unsightly water and vent pipes. This space can be put to good use by raising the water heater and installing a clothes-hamper cabinet beneath it.

The cabinet is constructed of $\frac{3}{4}$ " pine throughout with the exception of the door, top, and corner post. Cut the 2" by 11" vent in the 5" wide board beneath the door before nailing on the door frame. The door itself measures $23\frac{3}{8}$ " by $15\frac{7}{8}$ " over all. Hang it with $\frac{3}{8}$ " offset cabinet hinges. Nail the three bottom slats even with the top of the lower crosspiece of the door frame and on top of the rear cleat. Finish by nailing a molding around the bottom. Paint the cabinet to match the other woodwork. Connect



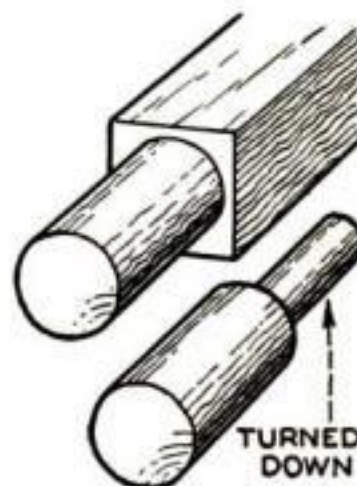
The water heater rests on the cabinet, which occupies space that would otherwise be wasted

the tank as shown in the plumbing detail.

The hamper is made by joining $\frac{1}{2}$ " hardware cloth to a 6-gauge wire hoop. The hamper measures 20" high and 14" in diameter. The bottom is cut from $\frac{1}{2}$ " plywood in which plenty of 1" holes are bored.

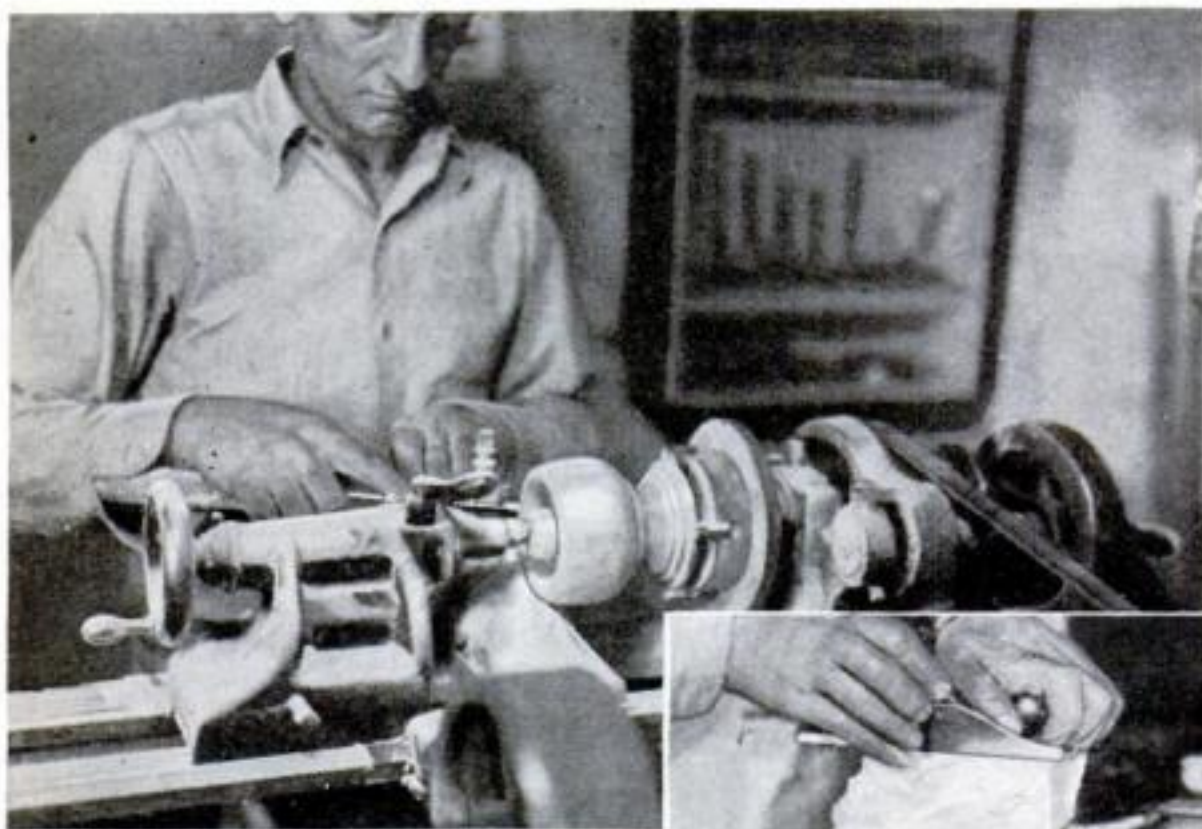
Replacing Broken Tenon on End of Chair Rung

CHAIR rungs or legs that break off at the dowel or tenon cannot, as a rule, be repaired with a dowel in the ordinary way because a hole cannot safely be bored into the end as large as the hole in the adjacent member. To overcome this difficulty, turn a piece of hardwood down to the full size of the original tenon, then reduce part of this so it can be inserted in the leg or rung.



Craftwork with Alabaster

... A BEAUTIFUL, INEXPENSIVE STONE THAT CAN BE SAWED, PLANED, AND TURNED LIKE WOOD



Above, turning a bowl. The stone is held in a chuck and supported by the tailstock center. Right, planing a flat slab for a desk set. At the extreme right is shown how a fifty-pound rock is cut with a saw



ANCIENT craftsmen used alabaster for some of their most beautiful and costly articles, and the general impression is that the material must therefore be very expensive. In reality this fine gypsum rock is found in many parts of the country and sells for about \$1.25 a hundred pounds. Its low price and the ease with which it can be worked make it an excellent material for school shops and home workshops. Pieces weighing 50 lb. or more are the most economical to buy because they do not require crating for shipment by freight.

Because of its softness, alabaster can be sawed, planed, drilled, and turned on the lathe. If much work is to be done, it is advisable to have a separate set of tools to use on it—an old saw, a set of lathe tools made from worn-out files,

and drills that have lost their cutting lands and are no longer fit for metal drilling. Alabaster does not damage regular tools, but it causes them to lose their cutting edges faster than wood.

To prepare pieces of alabaster, saw them off as near the finished size as possible. Material can be saved by sawing off the corners of pieces that are to be turned in the lathe. Flat pieces are treated just like a block of wood, but a block plane works better than a smooth plane because of its low cutting angle.

Alabaster should be mounted in the lathe by fastening it to a faceplate or in a chuck and supporting it with the tailstock. A spur center is likely to grind out a hole in the end if the piece is mounted between centers. In turning bowls, a small piece is left



An alabaster bowl with beautiful veining and clear, delicate color

By D. C. MARSHALL

in the center until the job is finished, and then this center can be cut off. Lamps may be made in two pieces like wooden lamps. Bracelets and similar articles are turned on the faceplate from flat pieces. If the dust is objectionable, the stone may be turned under water, which will prevent the small particles from flying about.

When the turning or other cutting is finished, the alabaster should be sanded to a very smooth surface. The first sanding is done with moderately coarse paper such as No. $\frac{1}{2}$; and the finish sanding is done with 6/0 or 8/0 garnet finishing paper.

The actual finishing is very simple. The surface is merely coated with boiled linseed oil, which is well rubbed in with a soft cloth. After the oil has dried, a high-grade furniture or automobile wax is applied. This gives the final polish and brings out the full beauty of the stone.

Well-designed pieces of alabaster bring good prices. Large pieces, when trimmed with a saw for turning, leave many small



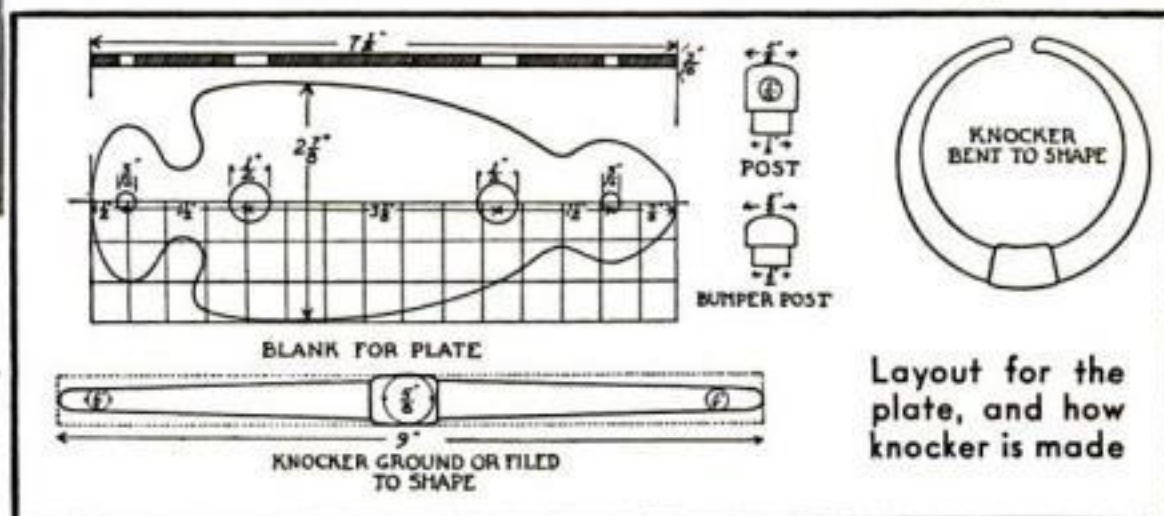
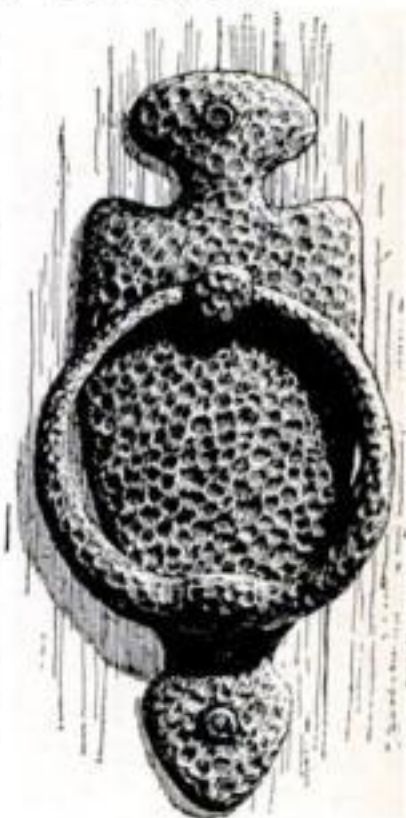
A decorative pair of small alabaster candleholders

corners that can be converted into buttons, belt buckles, beads, and other small novelties. If the stone is used to best advantage, a hundred pounds should produce at least fifty dollars worth of finished articles of various sizes.

Door Knocker of Hammered Brass



A HAMMERED-BRASS knocker like the one illustrated can be made from a scrap piece of $\frac{3}{16}$ " sheet brass, 3" by $7\frac{1}{2}$ ", and a 12" length of $\frac{5}{8}$ " round brass rod. Cut out the plate with cold chisel and hack saw, and hammer on one side with a ball-peen hammer. The knocker, after being tapered, is heated to a cherry red and allowed to cool gradually so that it can be bent. It also is hammered all over. Clean with muriatic acid, wash, and polish; or, if an antique finish is preferred, heat the brass evenly until dark, burnish the high lights with fine emery paper, and polish with floor wax.—D. H.



Layout for the plate, and how knocker is made

Wings

By
WALTER E. BURTON

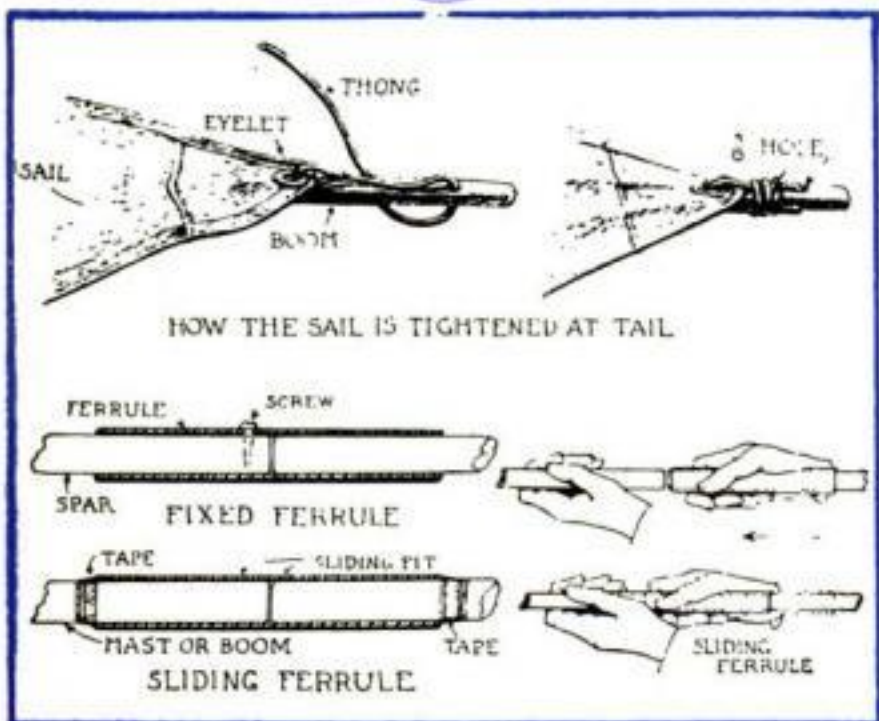
THIS skate sail, which will take you over the ice with the swiftness of the wind, is patterned after a design suggested by the Skate-Sailing Association of America. It is one of the easiest types to make and is suitable for all-around use.

For normal pleasure sailing, a sail of 38 sq. ft. will suit the average youth. For competitive sailing, however, sails usually have an area of about 1 sq. ft. for each 2½ lb. of the skater's weight. Pleasure sails require only 70 per cent of this area.

The secret of a successful sail is taut cloth. Use a good grade of sheeting, unbleached muslin or, best of all, a sailcloth such as that commonly called No. 1 Egyptian, 30" or 40" wide. Cut the cloth into two triangular sections so that, when sewed together, they form a kite-shaped sail having a seam along the middle and selvedge edges along the two longest boundaries. When sewing the pieces together, draw them in a bit so the selvedge edges curve inward slightly. Then when the sail is pulled taut, the edges will be unwrinkled. Use non-stretching cloth tape at least 1" wide to strengthen all four edges of the sail and to reinforce the central seam. Before applying the tape, sew pockets 2" to 2½" deep on the three corners at the front of the sail, and a reinforcing patch at the tail (most pointed) corner. Fold pieces of sail cloth double, place them with the folded edges inward in the positions shown, and stitch in place to form the pockets and reinforcement. Near the tail, insert a brass eyelet (grommet) to receive an 18" to 24" rawhide thong, cod line, or ⅜" white cotton line for stretching the cloth taut. A reinforcing triangle of cloth is desirable at the front end of the sail.

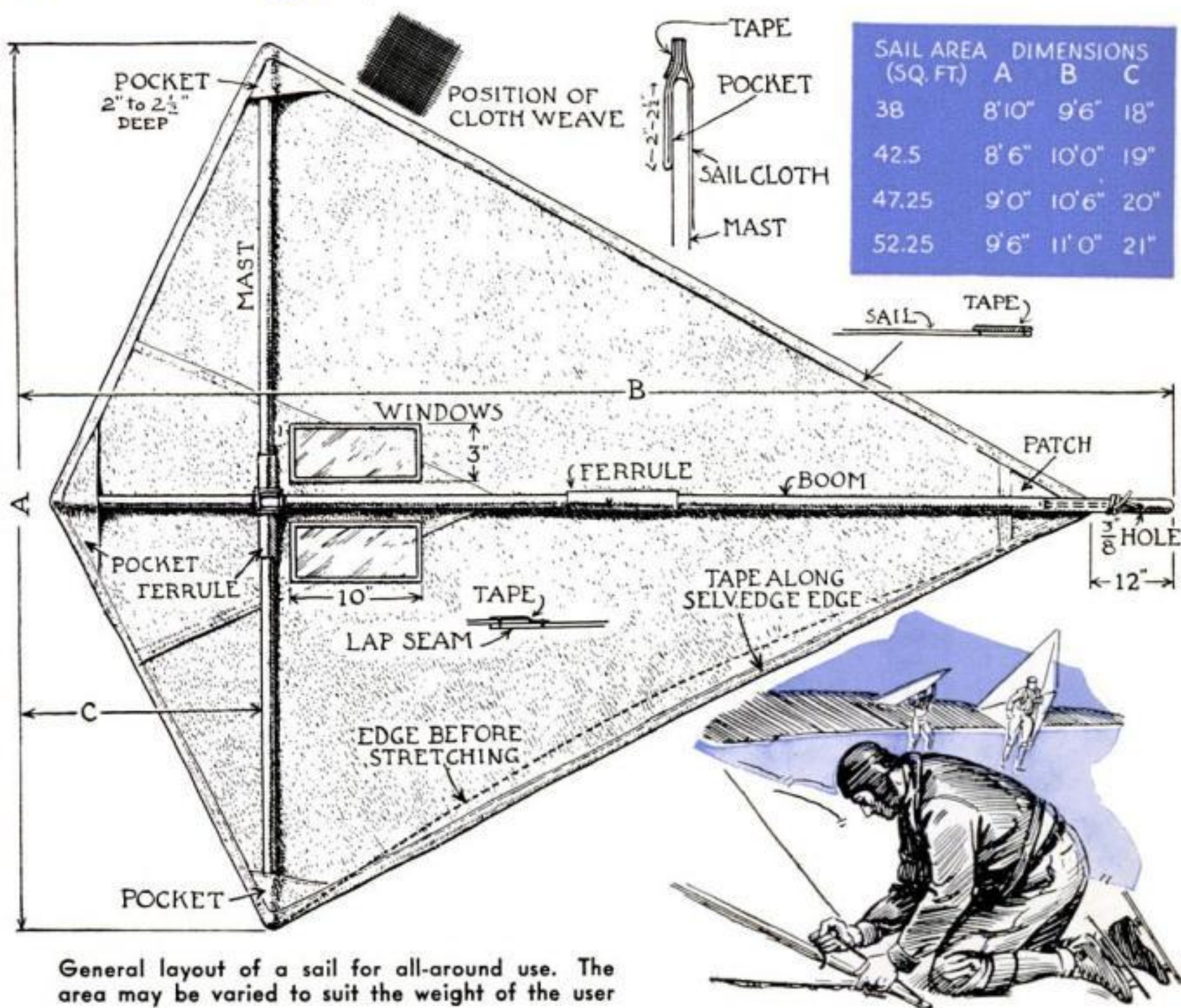
Make the long boom and the shorter mast of spruce, if you can get it; or of ash, sound pine, or other wood. The boom and mast (spars) are 1¼" thick in the middle and taper to 1" at the ends. Give them two coats of spar varnish.

**YOU CAN
HAVE LOTS
OF SPORT
ON THE ICE
WITH THIS
SAIL**



Method of stretching the cloth and two types of ferrules commonly used—fixed and sliding

For Your Skates



For easy carrying construct the spars so they can be taken apart in the middle. To do this, make a ferrule of a 10" piece of 16-gauge duralumin or 18-gauge brass tubing. It is fastened to one of the halves with a brass screw. The pockets into which the ends of the mast fit, being 2" or 2½" deep, permit the cloth to be stretched enough for the mast to enter.

Many skate sailors employ a sliding-ferrule arrangement on the spars, and pockets on all four corners of the sail, so the cloth can be stretched without using thongs or other gadgets. The ferrule is slid along one section until the wood end is uncovered. Then the end of the other spar section is placed against the first, and the joint pressed down to stretch the sail. The ferrule is then pushed over the joint to lock it. A ring of adhesive or friction tape limits the ferrule

movement one way; and similar tape can be wrapped about the other end.

The mast and boom must be fastened securely where they cross with the standard crossed-spar lashing. One objection to the use of sliding ferrules is that the skater usually has to crawl across the sail, as it lies on the ice, to work them!

Many skate sailors use bamboo for spars in spite of its undesirable limberness, wrong taper, and tendency to split. If you want to try it, bind the joints firmly with adhesive or friction tape, or with fishing line over which varnish is applied. Attaching ferrules may prove a problem. If the bamboo is cut at the joint, use a rasp and sandpaper to work it down to fit the ferrule. If cut between joints, insert a glue-covered plug into the hollow end.

The two windows, covered with sheet

celluloid, enable the skater to see where he is going. A way of attaching the windows, suggested by W. Van B. Claussen of the Skate-Sailing Association of America, is to stick them on with adhesive tape before cutting the sail. Use a coarse stitch to secure the adhesive more firmly to celluloid and cloth, and then cut out the portion of sailcloth covering the window.

To assemble the sail, insert the mast ends into their pockets. The cloth should be moderately stretched by the mast at this stage. Put the front end of the boom in the front pocket and run the thong, which is sewed to the tail corner, through the hole near the other end of the boom. Then run the thong through the eyelet as shown, and pull the cloth to drumhead tightness. Wrap the thong around the boom, slip one end under a turn, and pull it tight. Do not tie a knot in it, or it will be difficult to loosen. Of course, if you use the sliding-ferrule method, you do not require a tail thong.

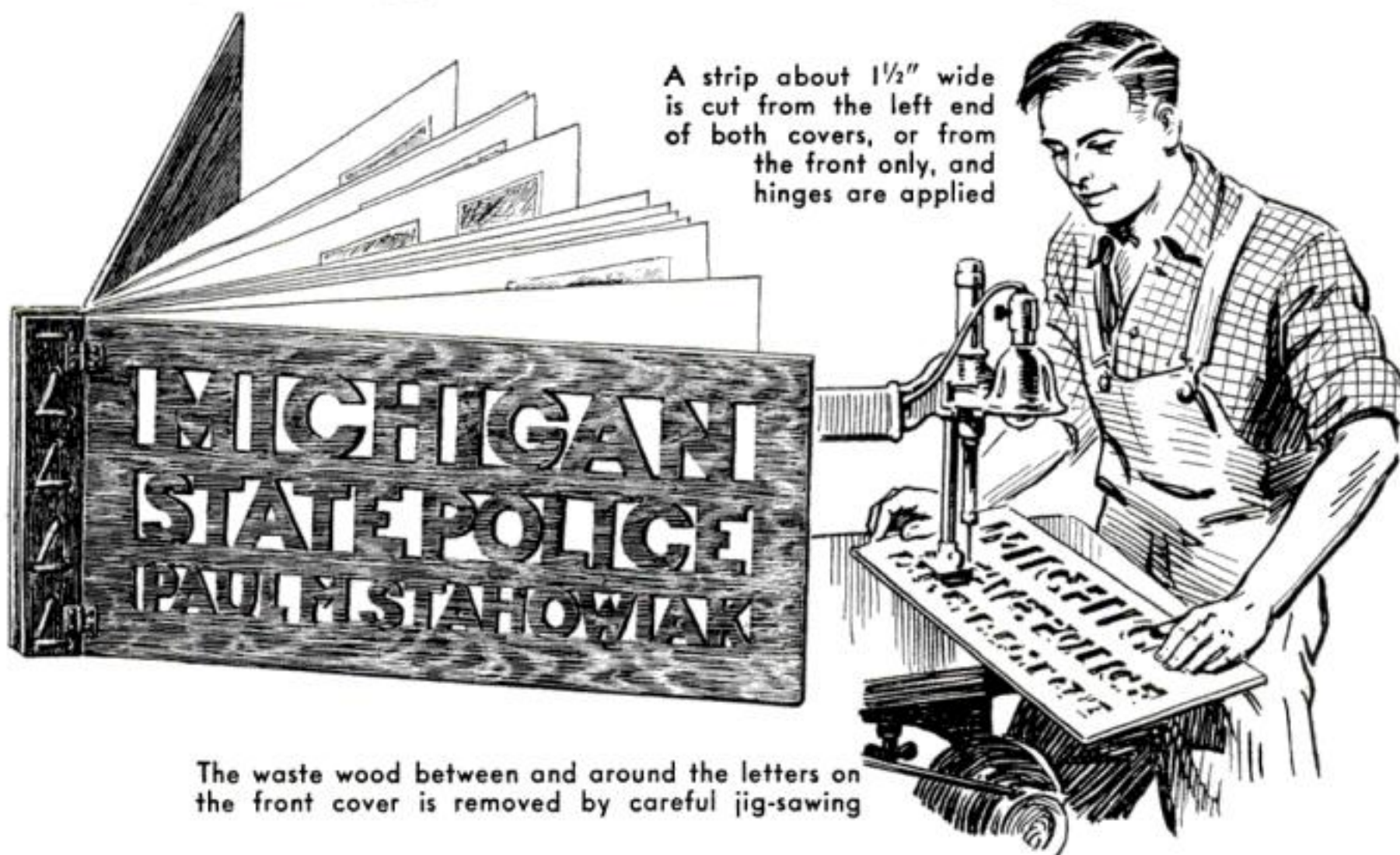
Ends of spars entering pockets should be

rounded and padded with cloth or tape. The mast always goes between the boom and the sailcloth.

In using the sail, learn to pick it up and hold it over the head by the front edges. It will float out on the wind, and from that position can be swung down until the boom rests on your shoulder and the tail drops a little. Grasp the mast below the boom, using the nearer hand; and lean against the sail as it is forced toward you by the wind. Keep your feet 4" or 5" apart, the one nearer the sail leading the other. In stopping and making turns, swing the sail overhead.

The two most important requirements for good sailing are skates properly sharpened, which means blades free of transverse grinding-wheel grooves, and a sail fitting snugly and taut on the spars.

The sail described can also be used for ski sailing. An inch or two of snow on lake ice is good. Over the ground, several inches of snow with a heavy crust, and an inch or two of soft snow on top of that, are suitable.



Jig-Sawed Plywood Cover Used on Large Album

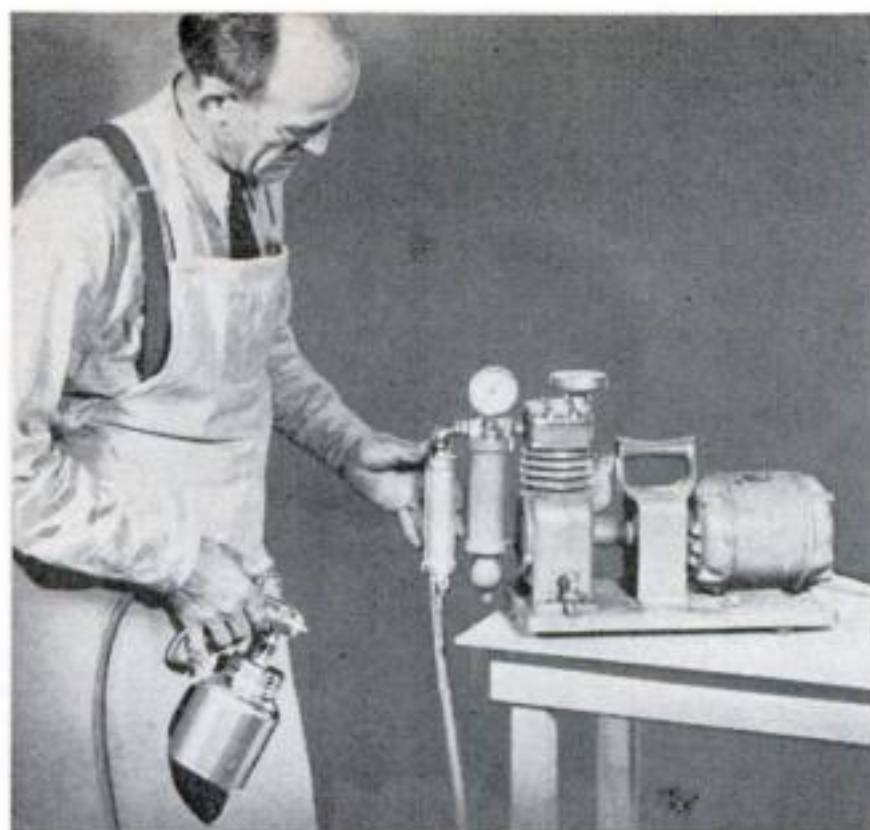
MORE substantial than usual, yet quite attractive, is a picture or clipping album with the cover and back made of ¼" plywood. A good size is 12" by 18".

On the cover lay out your name or any desired title in block letters, then cut away the waste around the letters on a scroll saw. The whole can be laced together with leather thongs or heavy cellulose cord. A good finish consists of stain and several coats of varnish, although the natural wood, if pro-

tected with varnish, is also very pleasing. The album shown was made by Paul M. Stahowiak, of the Michigan State Police.

Silk Stockings Strain Paint

DISCARDED silk stockings are useful for straining paint and enamel. It is especially important to strain paint that is to be sprayed because there is then less danger of spattering or clogging.—L. C. H.

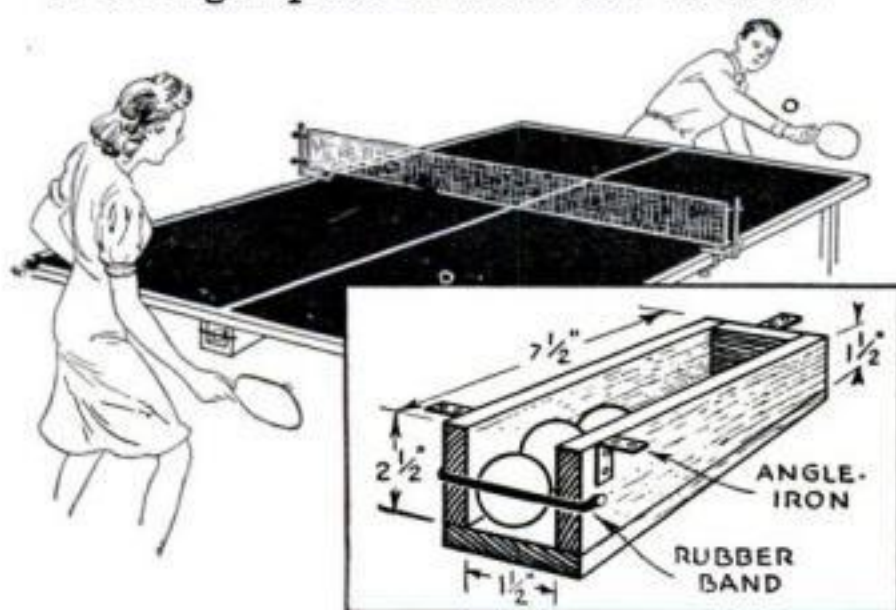


Oil Filter Connected to Air Compressor

OWNERS of portable power paint-spray outfits of the type illustrated above will find it less bothersome if the oil-and-water filter is connected directly to the air compressor instead of hanging it on the trousers belt as is usually customary. A small elbow, which can be obtained at any plumbing supply, is used to connect the filter directly to the compressor.

Table-Tennis Balls Kept in Holder under Table

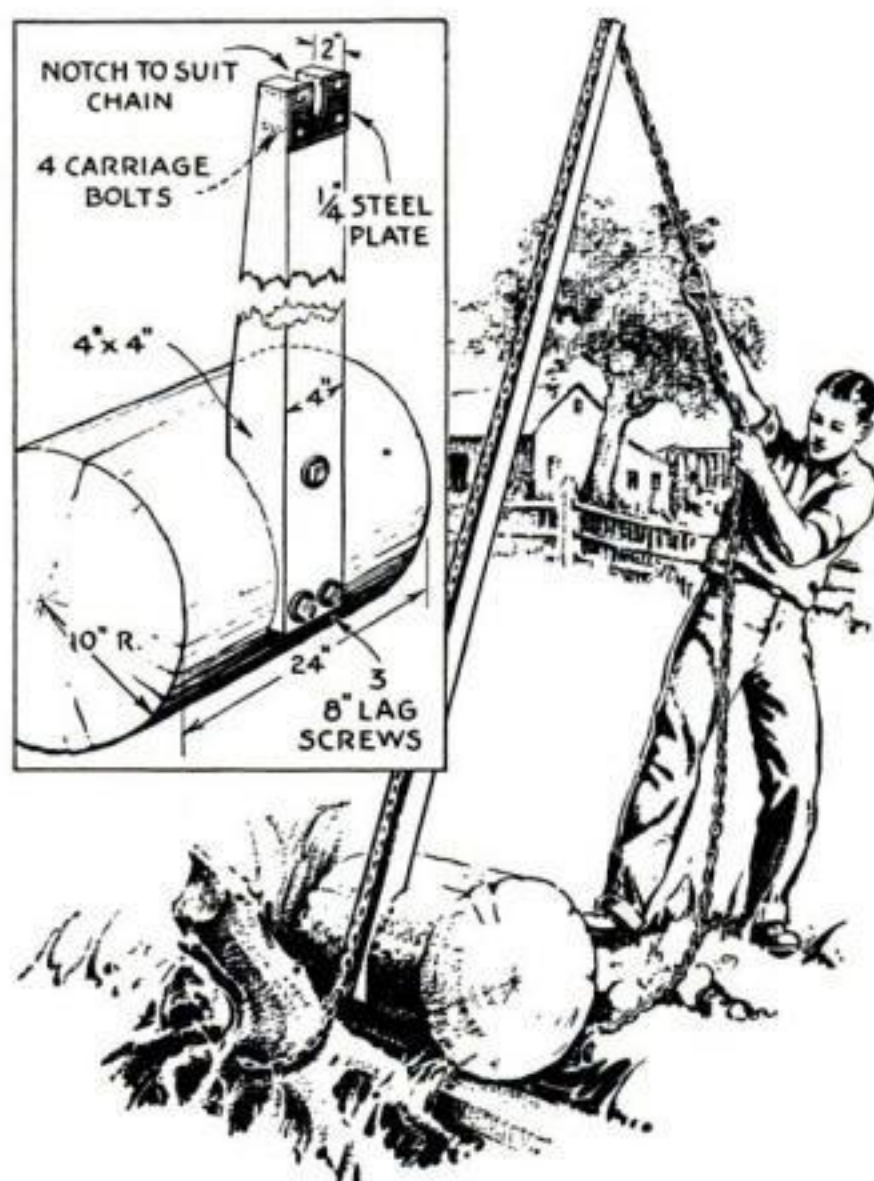
TABLE-TENNIS balls can be stored conveniently in a slanting holder made as shown and fastened under the table with three small angle irons. To prevent the balls from rolling out of the holder, either a rubber band may be stretched across the opening or a hinged piece of wood can be used.



To keep the balls from rolling out of the holder, a wide rubber band is fastened across the opening

Small Stumps Removed with Homemade Puller

ALTHOUGH costing very little, this stump puller will be found useful for small stumps. A chain with a hook on one end is passed around the stump close to the ground and hooked on the side next to the puller. With the spar vertical and the puller close to the stump, hook the chain in the steel plate at the top of the spar and apply power at the loose end of the chain by hand or with a car or truck.—KENNETH L. KNULL.



Long Holder Replaces Ceiling Light Bulbs

A FIVE-CENT lamp-shade clip, if nailed to the end of a broom-stick, is handy for unscrewing old light bulbs from high ceiling fixtures and inserting new lamps. The clip is of the type sold for converting bridge lamp shades for use on table lamps and may be obtained at most hardware stores.—HARRY WALTON.

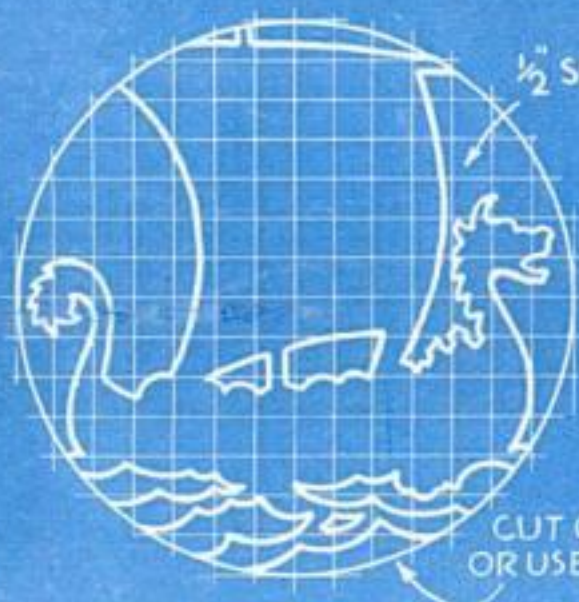


Magazine End Table

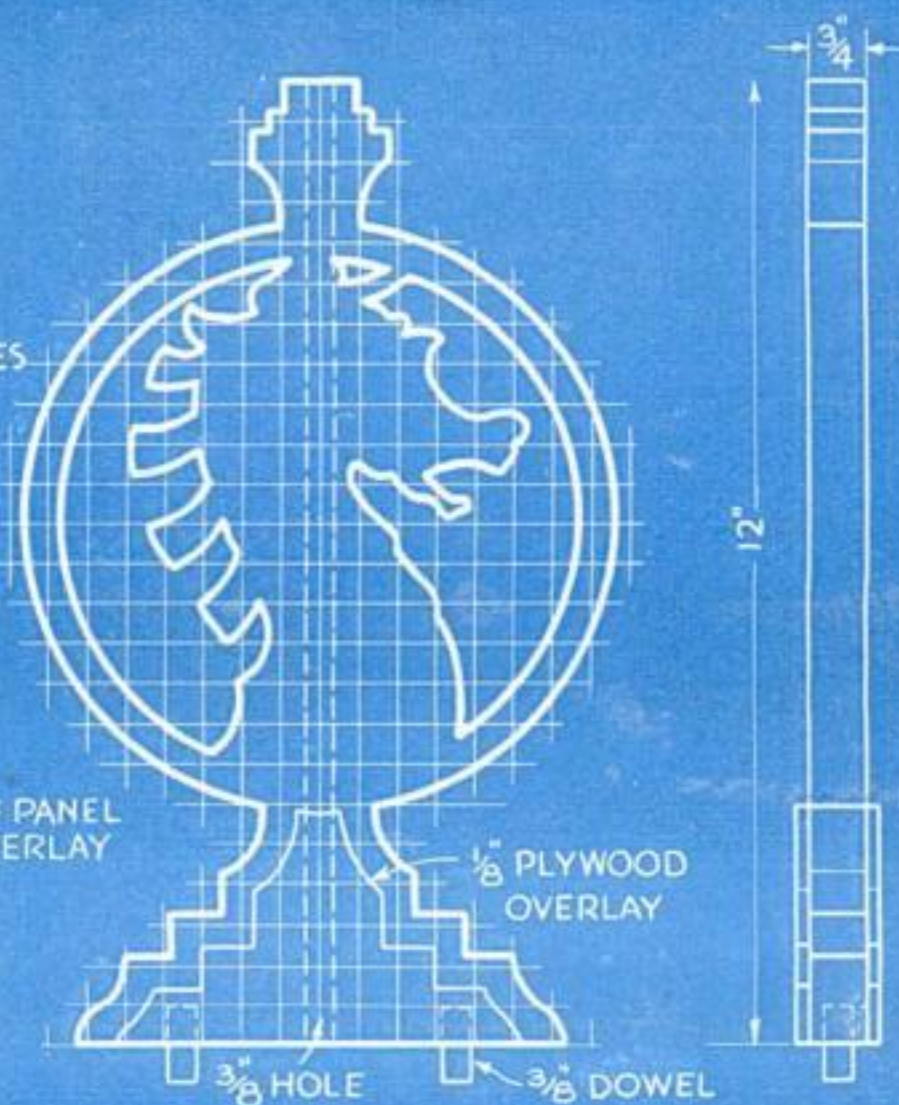


A COMMODIOUS end table which holds both magazines and books, and a reading lamp to match are combined in this unusual piece of living-room furniture. If it is to be enameled in a solid color, an inexpensive softwood such as pine may be used.

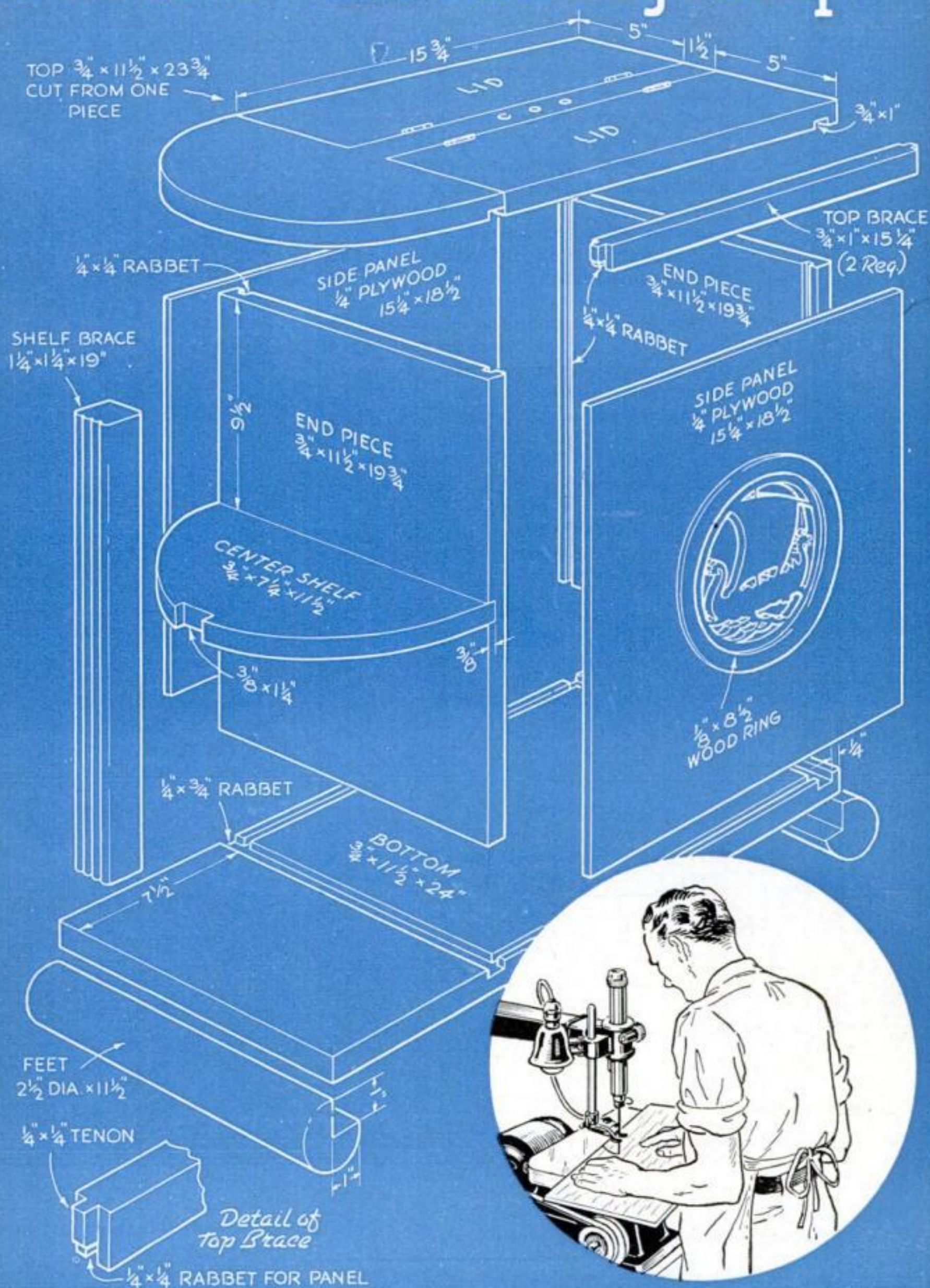
Stock $\frac{3}{4}$ " thick, rabbeted and dadoed as shown, is used for the top, end pieces, bottom, and semicircular shelf. The large side panels are $\frac{1}{4}$ " plywood with a Viking-ship design cut in the center. A narrow ring of $\frac{1}{8}$ " or thicker plywood is cut and glued around the design. The compartment inclosed by these panels is intended for large magazines, which are reached by opening the lids in the top. The lamp is jig-sawed from $\frac{3}{4}$ " stock and doweled to the top. — CHARLES JEGLINSKI.

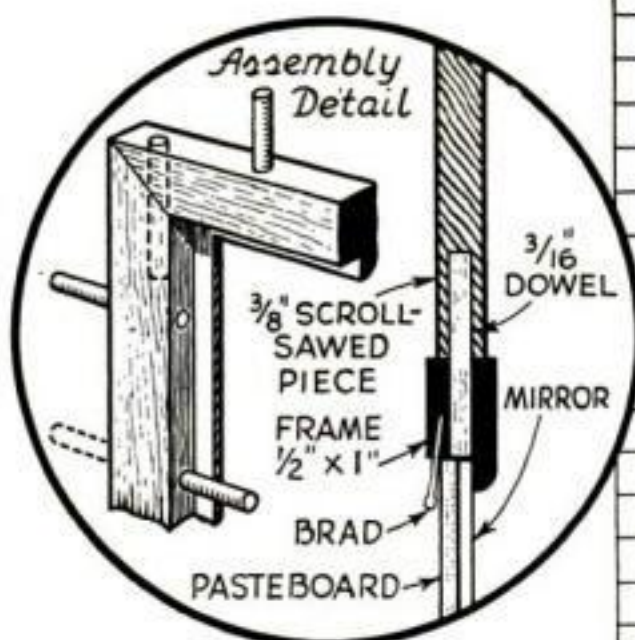


Jig-sawed Viking designs ornament both the plywood side panels and the lamp. The lamp base is thickened by adding overlays on each side

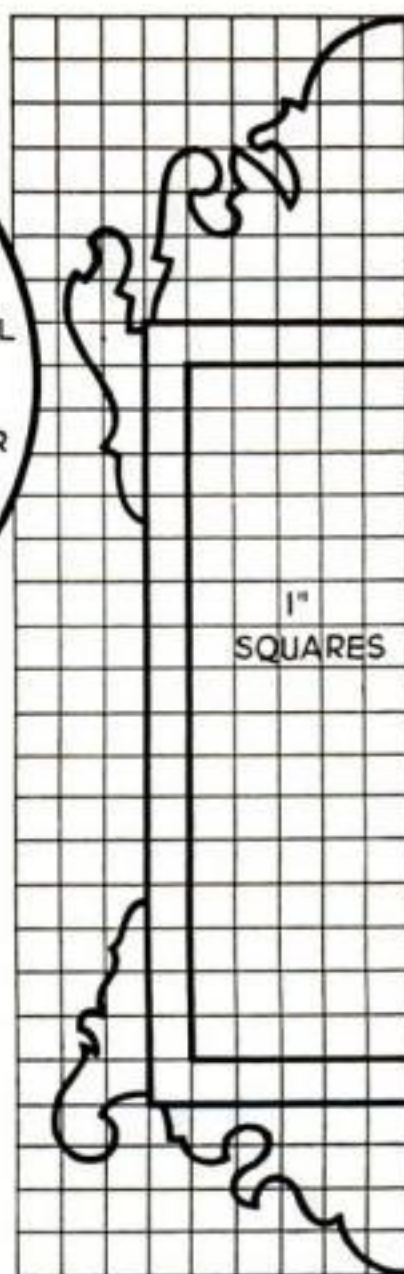


Combined with Reading Lamp





The frame is assembled with mitered joints, and then the scroll-sawed wings are fastened to it with dowels. The dimensions may be altered to suit a mirror of another size



Boudoir Mirror

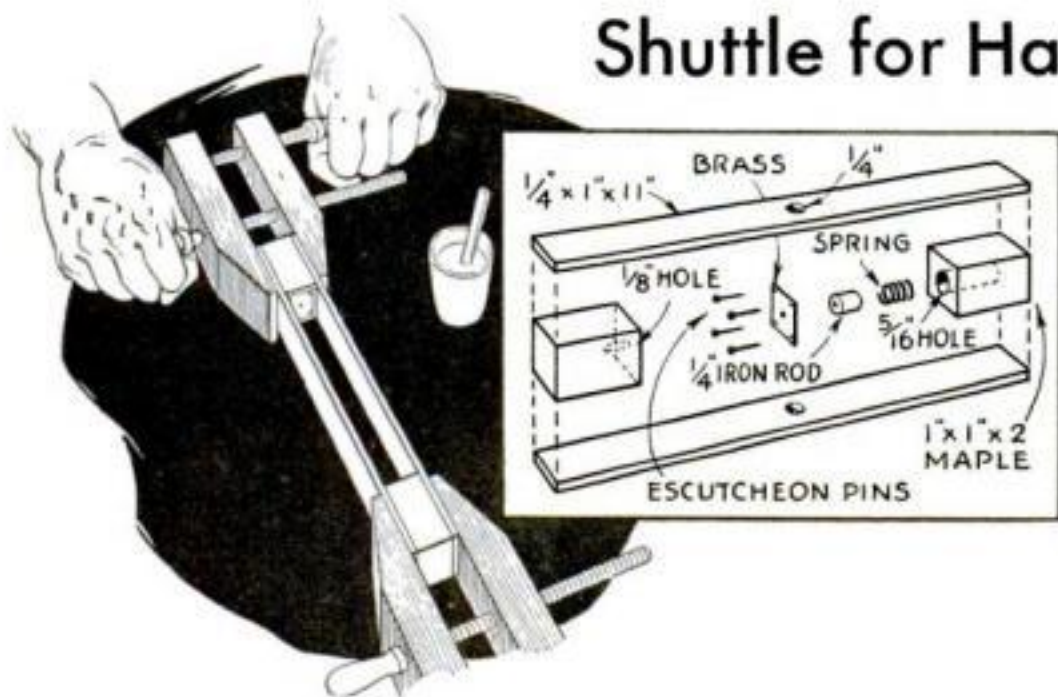
ORNAMENTED WITH SCROLLWORK

DECORATIVELY scroll-sawed mirrors of early American design, or boudoir mirrors as they are sometimes called, make acceptable gifts yet do not cost much for materials. A very simple way to construct such mirrors is shown in the accompanying drawings. The frame is made from $\frac{1}{2}$ " by 1" strips of mahogany, walnut, or other cabinet wood, rabbeted for the mirror and assembled with mitered joints. Each

joint is reinforced with a single $\frac{1}{16}$ " dowel inserted from the outside. Since the frame is comparatively light, the joints must be carefully fitted and well glued.

The scrollwork is sawed from $\frac{3}{8}$ " thick wood to match the frame and fastened with glue and dowels. The mirror is backed by a panel of heavy pasteboard and fastened with brads. If an old mirror of suitable quality is on hand, the frame may be modified to fit it.

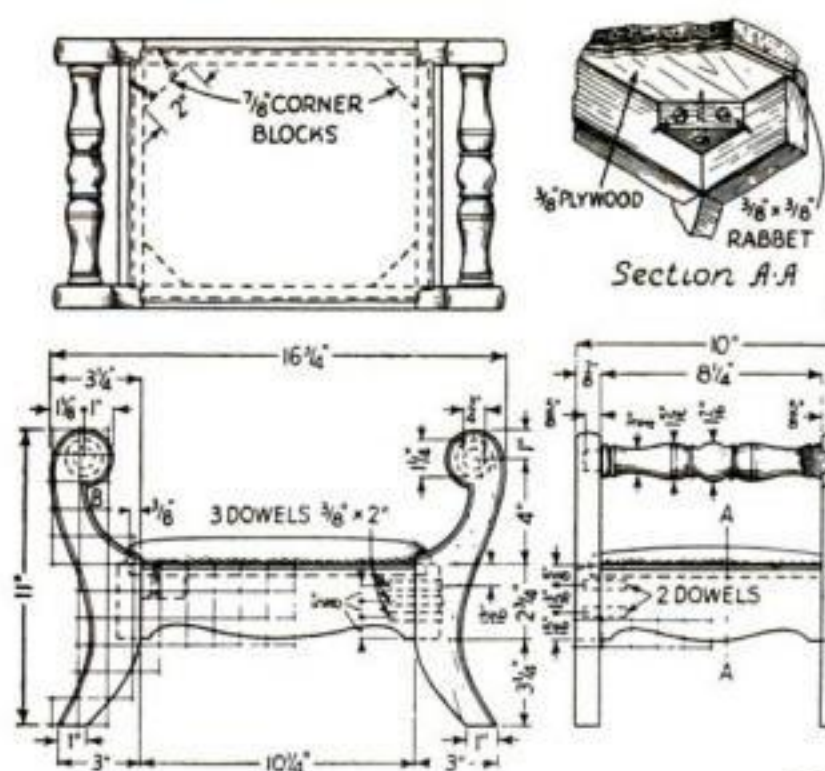
Shuttle for Hand Loom Easily Made



A SHUTTLE for a hand loom is easily made by the method illustrated. Cut the four pieces of maple and drill the necessary holes. Glue the parts together, holding them between hand screws, and, when the glue has set, shape the shuttle with a band saw or by hand. Finish with a rasp, file, and sandpaper, and apply two coats of varnish.

Cut the spindle from a piece of $\frac{1}{8}$ " iron wire (an old coat hanger will do). It should be $\frac{3}{8}$ " longer than the distance between the end pieces. Push the rod against the spring in one end and then let the spring push it into the hole in the other end.—JOHN H. CLAYTON.





A GRACEFUL Footstool

IN THE STYLE OF DUNCAN PHYFE

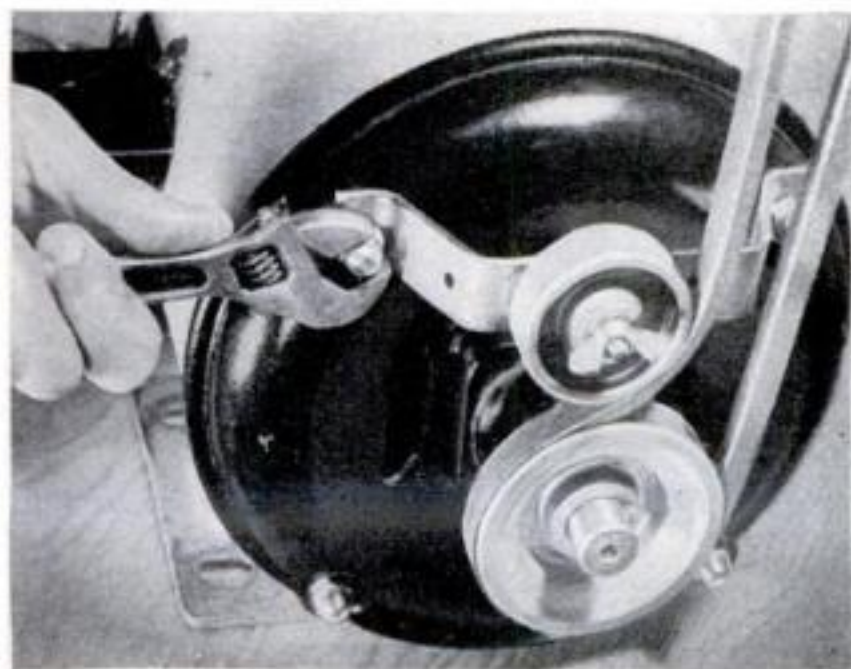
TO THE discriminating judge of furniture, this footstool of the Duncan Phyfe period has that handmade quality which cannot be duplicated by factory methods. It may be built of mahogany, maple, or birch.

The original stool was made of beautiful curly maple and stained with a half-and-half mixture of boiled linseed oil and tur-

pentine to which dry burnt umber had been added to give a slightly darker tone. This was followed with two rather thin coats of shellac, rubbed with 00 steel wool and polished with wax. Upholster the seat with two thicknesses of upholstery felt or with cotton bats well pressed down, and cover with any harmonious fabric.—CHARLES A. KING.

How to Reduce Belt Slip

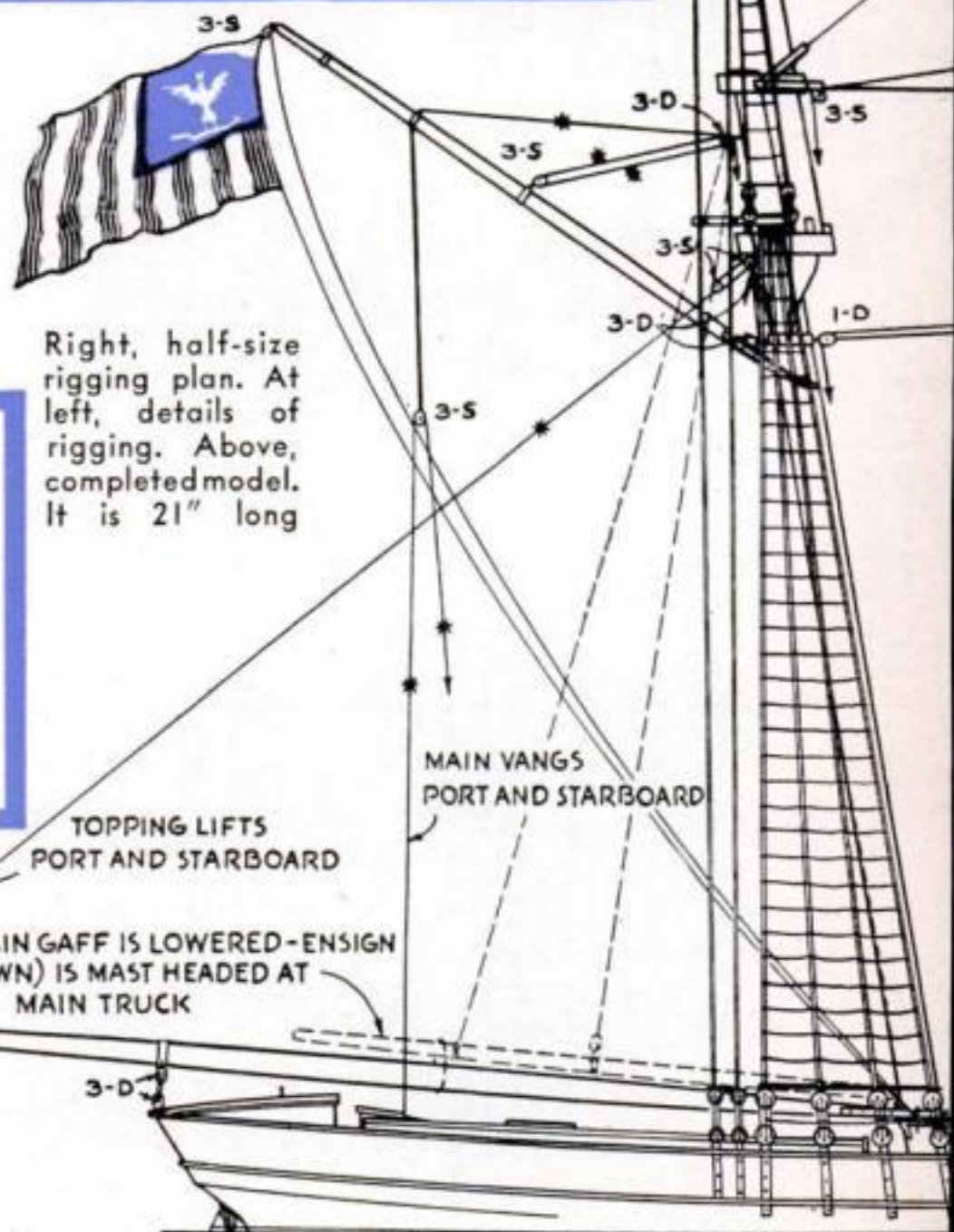
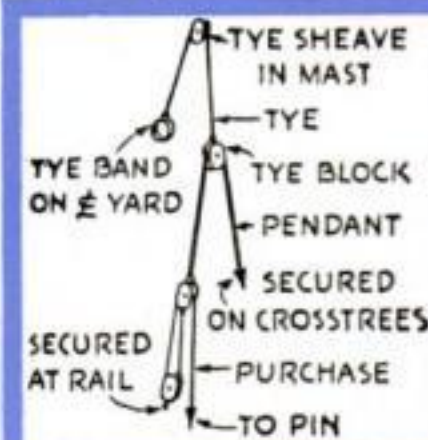
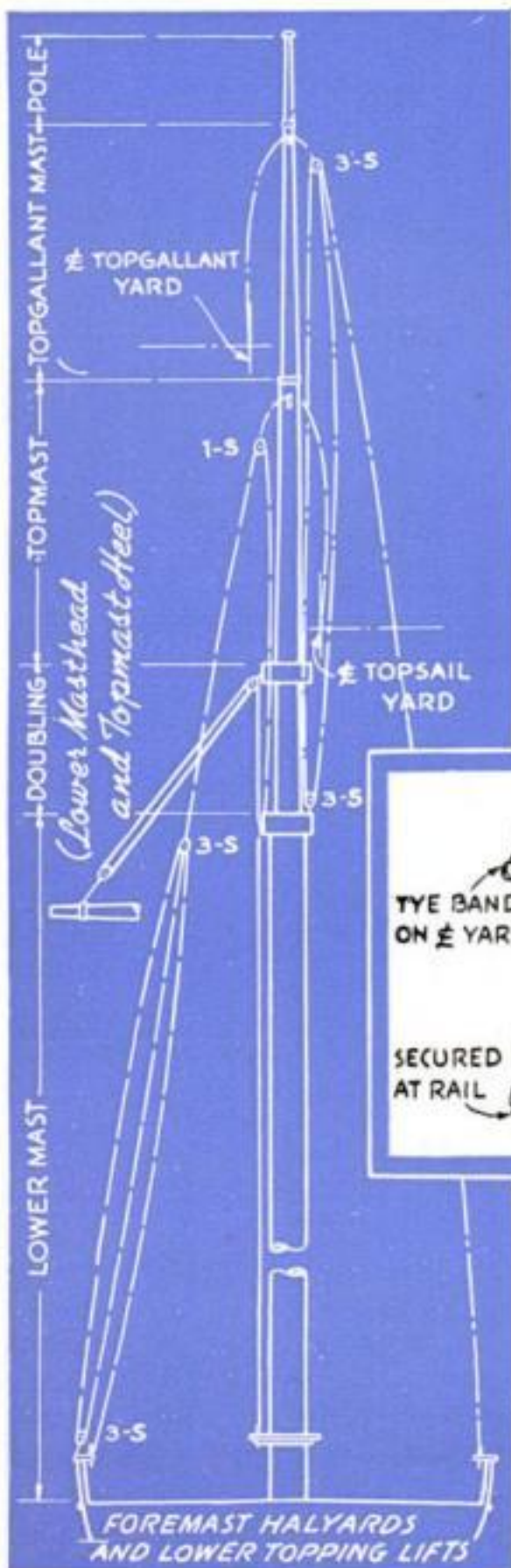
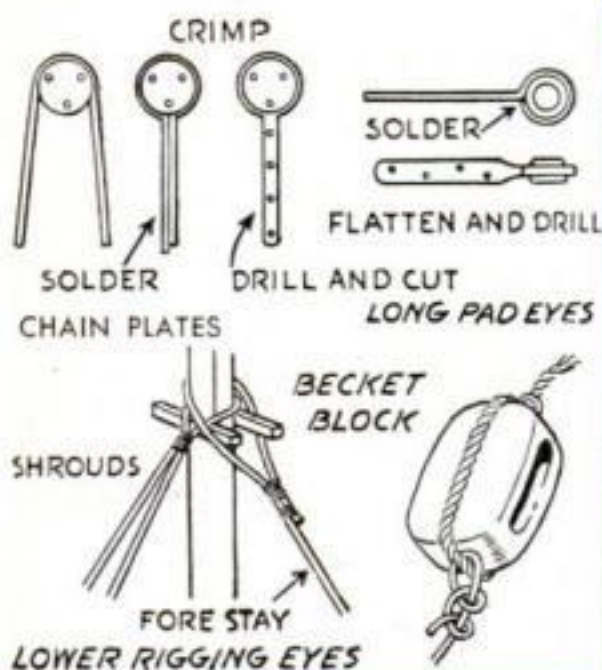
WHEN small pulleys must be used to give a machine the correct speed, the belts often have a tendency to slip. A simple way to prevent this is to mount a roller-skate wheel on a suitable bracket as shown below. This method works equally well on V-type or flat belts.



Postage Stamps Ornament Parchment Lamp Shade

CANCELED postage stamps form the decorative element of this novelty lamp shade. The base is a plain parchment shade of the type that may be purchased complete at almost any appliance store. The postage stamps should be mounted firmly and smoothly with thin glue, rubber cement, or sodium silicate (water glass) and given a thin coat of varnish.—MRS. K. R. SIPPLE.

Rigging the "Joe Lane"



Right, half-size rigging plan. At left, details of rigging. Above, completed model. It is 21" long

THE U. S. Revenue Cutter *Joe Lane* was classed as a topsail schooner. If you have completed all the deck work and have the masting ready to be set in place as shown in the two preceding installments, you are ready to start rigging your model of this picturesque little ship.

First, however, strap and set up the dead-eyes. Make the necessary chain plates as shown. The simple knot for strapping the blocks is illustrated in the same group of drawings. Sizes of blocks and deadeyes are indicated in the rigging plan.

Although the rigging is a fascinating phase of model building, don't be in too much of a hurry to get started. Check back

carefully to make certain all other work has been completed. See that holes for the belaying pins have been drilled and that the pins fit tightly in place.

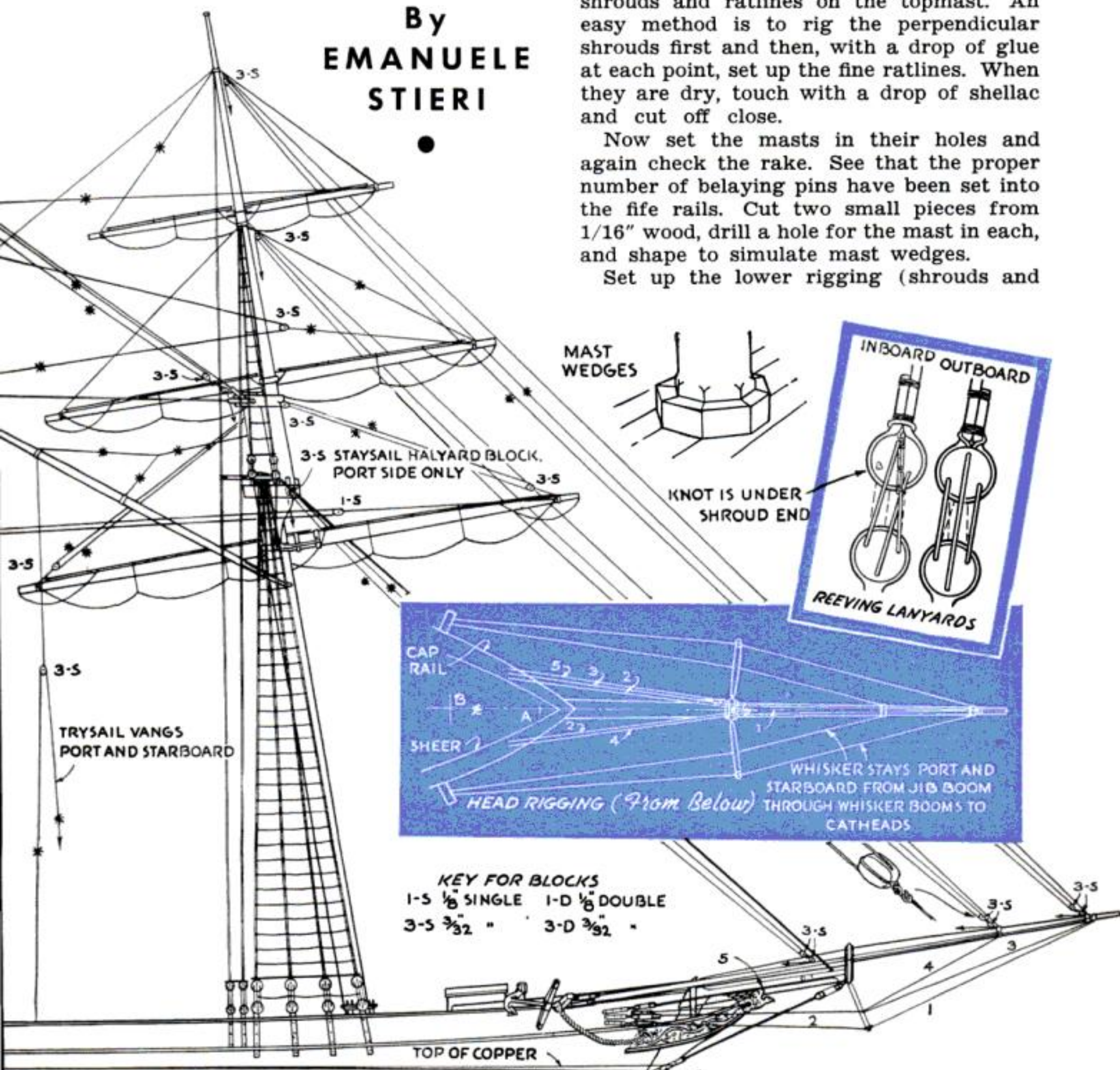
From the drawing lay out the lead from each rope, know where it starts and where it goes to, and whether it belongs to the standing rigging or to the running rigging. Use fine (No. 70) ecru thread for the running rigging (indicated with asterisks) and fine and medium (Nos. 70 and 16) black threads for the standing rigging. Be sure that every eyebolt and every cleat, to which the rigging is fastened and the blocks hooked, is in its proper place on the masts and yards.

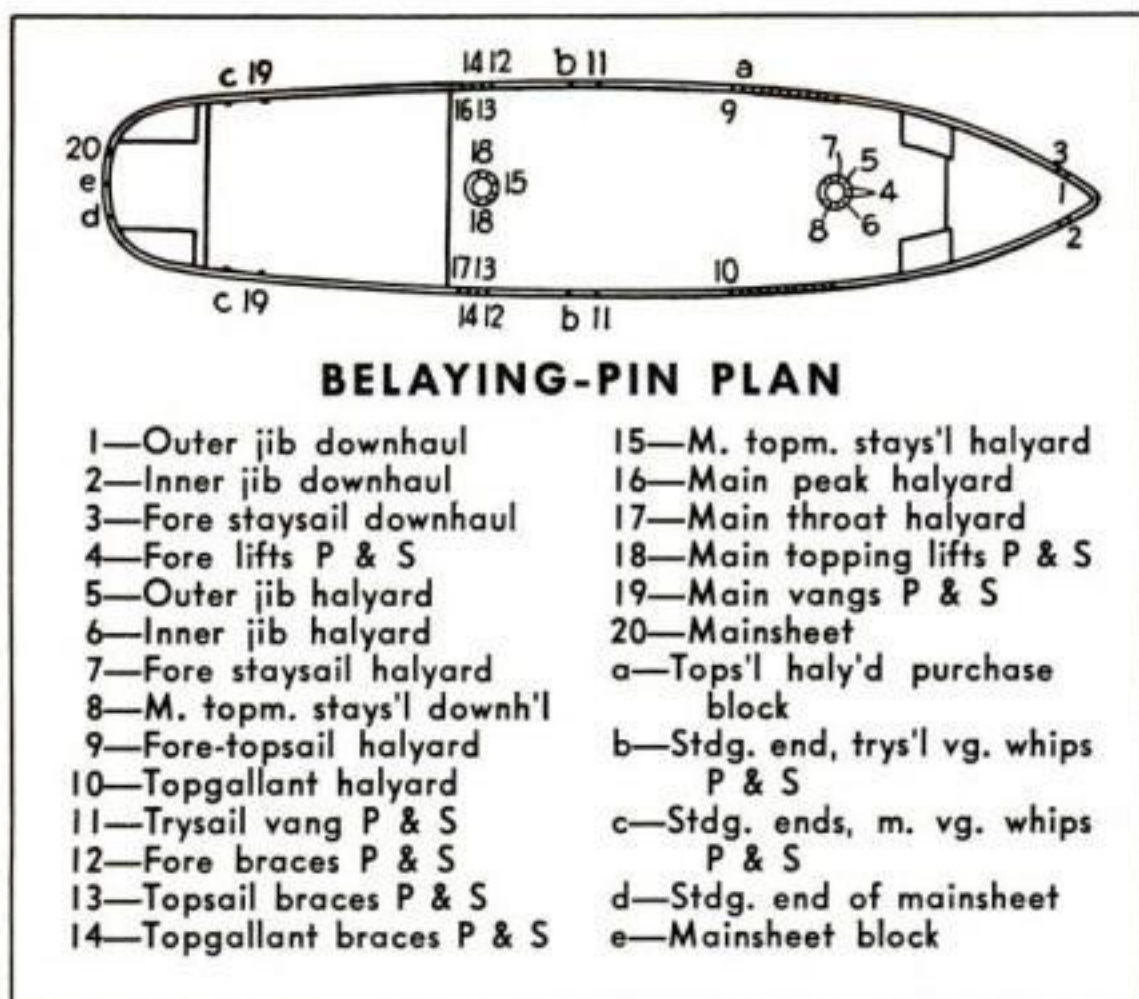
Before setting up the masts, place the shrouds and ratlines on the topmast. An easy method is to rig the perpendicular shrouds first and then, with a drop of glue at each point, set up the fine ratlines. When they are dry, touch with a drop of shellac and cut off close.

Now set the masts in their holes and again check the rake. See that the proper number of belaying pins have been set into the fife rails. Cut two small pieces from 1/16" wood, drill a hole for the mast in each, and shape to simulate mast wedges.

Set up the lower rigging (shrouds and

By
**EMANUELE
STIERI**





backstays) and the bowsprit rigging as indicated. Follow through by making all ratlines on foremast and mainmast.

To avoid confusion in rigging a ship of this type, arrange the standing rigging before placing the yards and gaffs. Now attach the yards and gaffs and continue with the rigging, starting with the bowsprit and

proceeding methodically aft.

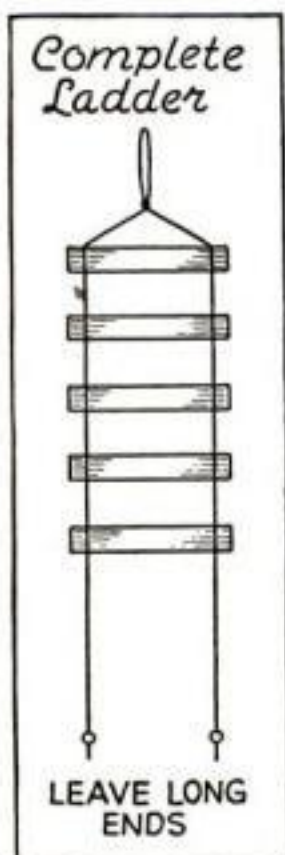
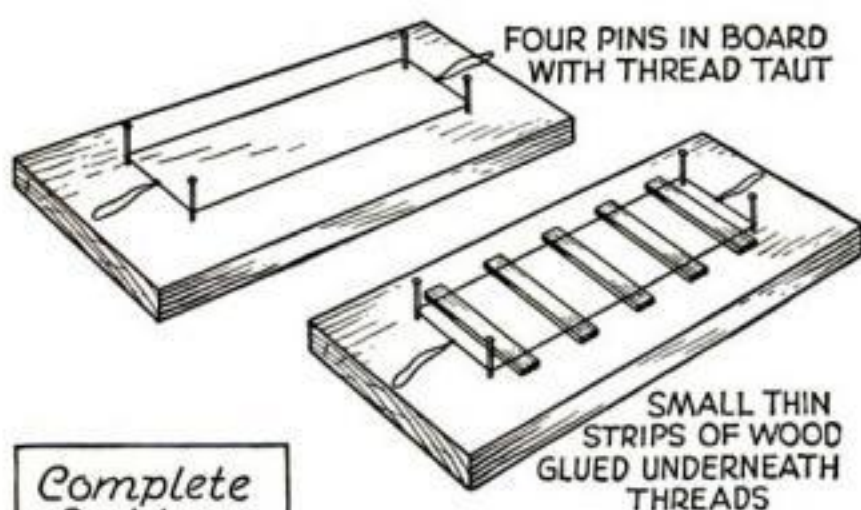
Note that the plan shows the yards in an impossible fore-and-aft position. When setting up lifts and braces, "square" the yards in a horizontal position, at right angles to the keel line. To avoid confusion, the following braces are shown on the drawing as if on one side only:

Topgallant—Standing end on yard band, then through double block at main topmast band, down through crosstrees, and to pin No. 14, port and starboard.

Topsail—Standing end on main topmast band, then forward to block on brace pendant, aft to block on mainstay span, and down through crosstrees to pin No. 13, port and starboard.

Lower—Standing end fast in becket and double block at main futtock band, forward to block on brace pendant, aft through double block on futtock band, and down to pin No. 12, port and starboard.

Any type of stand may be used. A simple one is shown in the photograph; another design appeared in the first installment.



Miniature Ladders for Ship Models

JACOB'S ladders give a touch of realism to a ship model that is often lacking. I always place such ladders over the bulwarks to reach slightly below the water line. They can easily be made of thin wood and thread, as shown in the accompanying sketches.—ANTONIO GELINEAU.

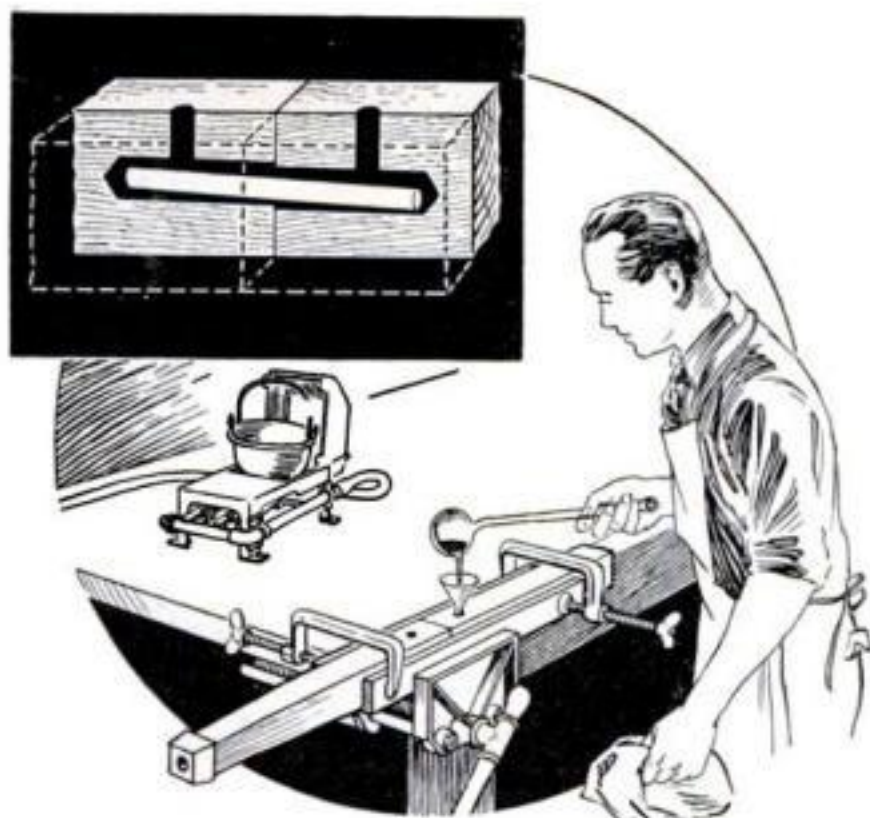
Cutting Sharp Carvings from Balsa for Models

IN FASHIONING small ship-model carvings from balsa wood, a cleaner result can be obtained if the lines are cut in lightly with a sharp knife and then molded into the wood with a blunt, round-pointed tool, such as a mimeograph stylus. This is also a much faster method.—ERWIN LA HAINE.

Pencils Bound Together

SHIPPING clerks, checkers, and others who use ordinary colored pencils can save time by fastening a red and a blue marking pencil together with rubber bands, as illustrated, so they point in opposite directions. This forms a handy double-end combination.





Steel Dowels and Babbitt Fix Broken Furniture

DIFFICULT furniture repairs, such as a broken table or chair leg, have been successfully made in a number of cases by using a steel dowel and Babbitt metal. The leg is sawed off square just above the break, and a new piece is turned, band-sawed, or carved to match the broken portion. A $\frac{1}{2}$ " hole is then drilled into the end of the leg and the new part which is to be joined to it. The holes do not have to be accurately registered.

Two $\frac{1}{4}$ " holes are next drilled as shown, to meet the larger holes in whatever position they will be least conspicuous. A $\frac{1}{4}$ " steel rod is placed in the $\frac{1}{2}$ " holes, and the two parts are clamped together and blocked up horizontally. Melted Babbitt metal is poured into one of the $\frac{1}{4}$ " holes until it appears at the surface of the other. Allow sufficient time for the metal to cool, then file it smooth at the $\frac{1}{4}$ " holes, and color and finish the new material.—C. F. BLAKE.



Linoleum-Block Cutters Aid in Soap Carving

FINE work on soap carvings can be done with linoleum cutters such as are used in making linoleum blocks for block printing. The cutters may be purchased in various sizes and shapes from art stores.

I have followed various patterns in doing soap sculpture, but prefer the figures illustrated in articles that have appeared in POPULAR SCIENCE MONTHLY on wood whittling, such as "Hobo Hank" (P.S.M., Jan. '37, p.71).—STANLEY SHERIDAN.

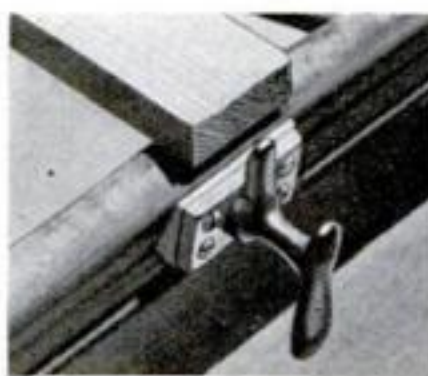


Cans for Holding Small Parts

Empty shoe-polish cans, because of their shape and the tight-fitting but easily opened style of lid they have, are useful containers for tacks, small screws, and parts of models and small fittings which require to be kept in dustproof containers.—L. G.

Ladder Supports Boards While Being Planed

WOODWORKING repairs often have to be made where no bench or flat surface is available for planing boards. In such cases a

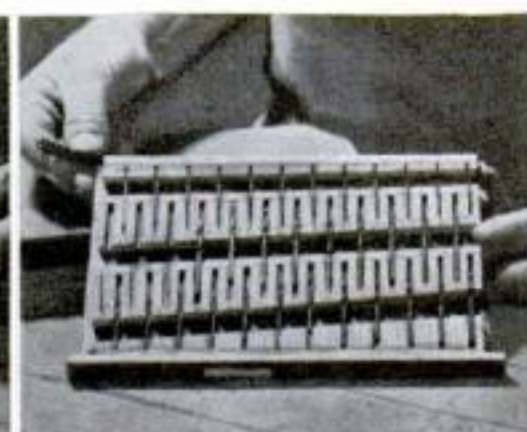
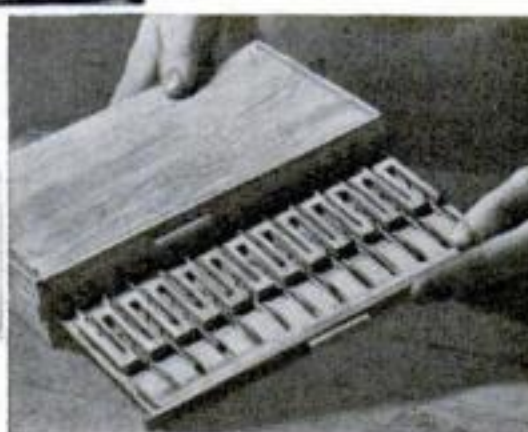


stepladder, if equipped with a case-ment latch as shown to act as a stop, makes a satisfactory planing bench. A small wooden wedge props the latch at right angles to the planing surface.

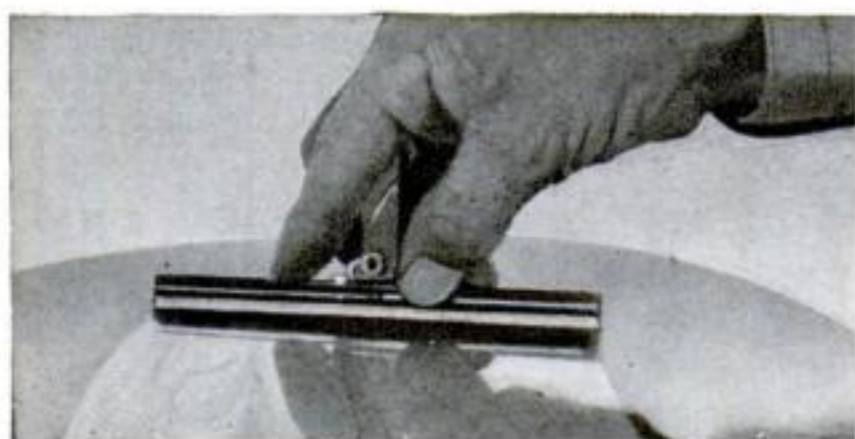


Light Wooden Case Holds Set of Twist Drills

HOME workshop enthusiasts who wish to make a case for twist drills that will protect them perfectly yet enable any size to be instantly selected, will find the design illustrated has unusual merit. This case holds a set of wire drills from 1 to 60. When the case is closed, each drill is locked in a separate pocket. The pockets are made simply by cutting slots in strips of plywood and gluing these strips to another piece of plywood with spaces between so that the drills can be picked up easily. In order that the smaller drills may be grasped without difficulty, extra strips, which are not slotted, are placed underneath the slotted strips in the top drawer.—MERLE TERRILL.



One drawer holds drills from 1 to 24; the second, from 25 to 60; the third, extra or broken drills

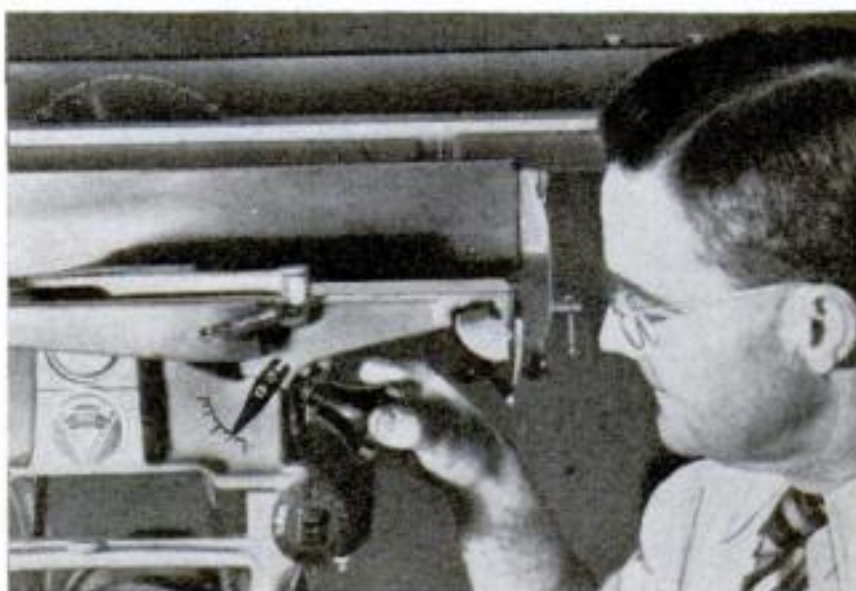


Scale Placed on Jointer to Show Depth of Cut

DEPTH of cut on a jointer can be quickly determined by the use of a scale as shown. Two $\frac{1}{8}$ " holes are drilled and tapped oppo-

Windshield Wiper Helps in Wet Sanding

AS AN aid in obtaining a smooth, glass-like finish on table tops or flat surfaces, especially if lacquered, an automobile windshield wiper is useful as shown above for removing the sludge while sanding and for facilitating the inspection of any remaining unevenness or "orange peel," as it is commonly called. The sanding is done lightly with the grain in sections of about 6" square with No. 360 or 400 waterproof sandpaper dipped frequently in water. The sludge formed by sanding is removed repeatedly with the wiper as the work progresses, until a smooth surface has been obtained, after which the finish is ready for polishing.



site each other in the base and rear table. The upper screw acts as a cam for the pointer, which has a $\frac{1}{8}$ " by $\frac{1}{2}$ " U-slot cut in the top. The lower screw is used as a pivot. The scale can be graduated from 0 to $\frac{1}{4}$ " by thirty-seconds, which is usually sufficient.

WHAT YOU CAN DO WITH Rubber Splicing Tape



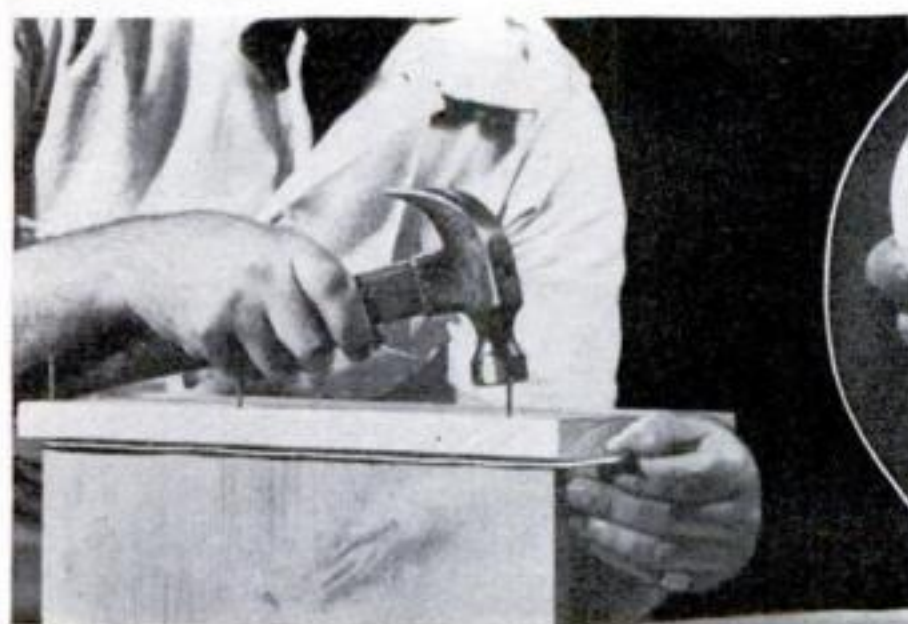
Tires for models, and ringlike gaskets



Padding a clamp so it won't leave marks



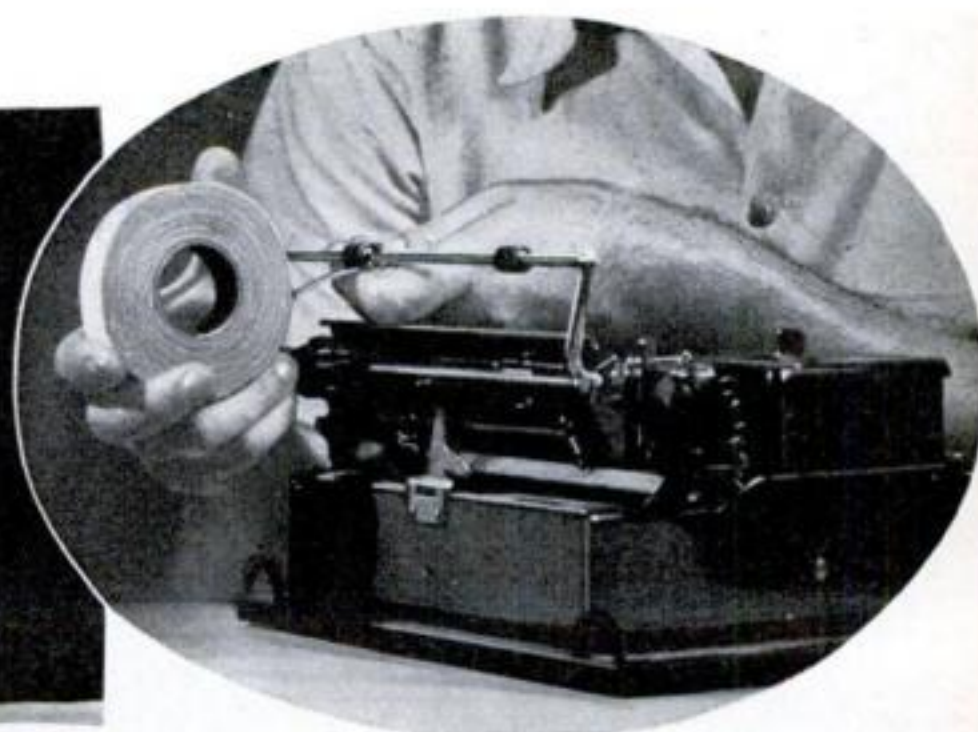
Adapting medicine dropper to fit bottle



Wooden tanks can be made water-tight by placing rubber tape in the joints before they are fastened



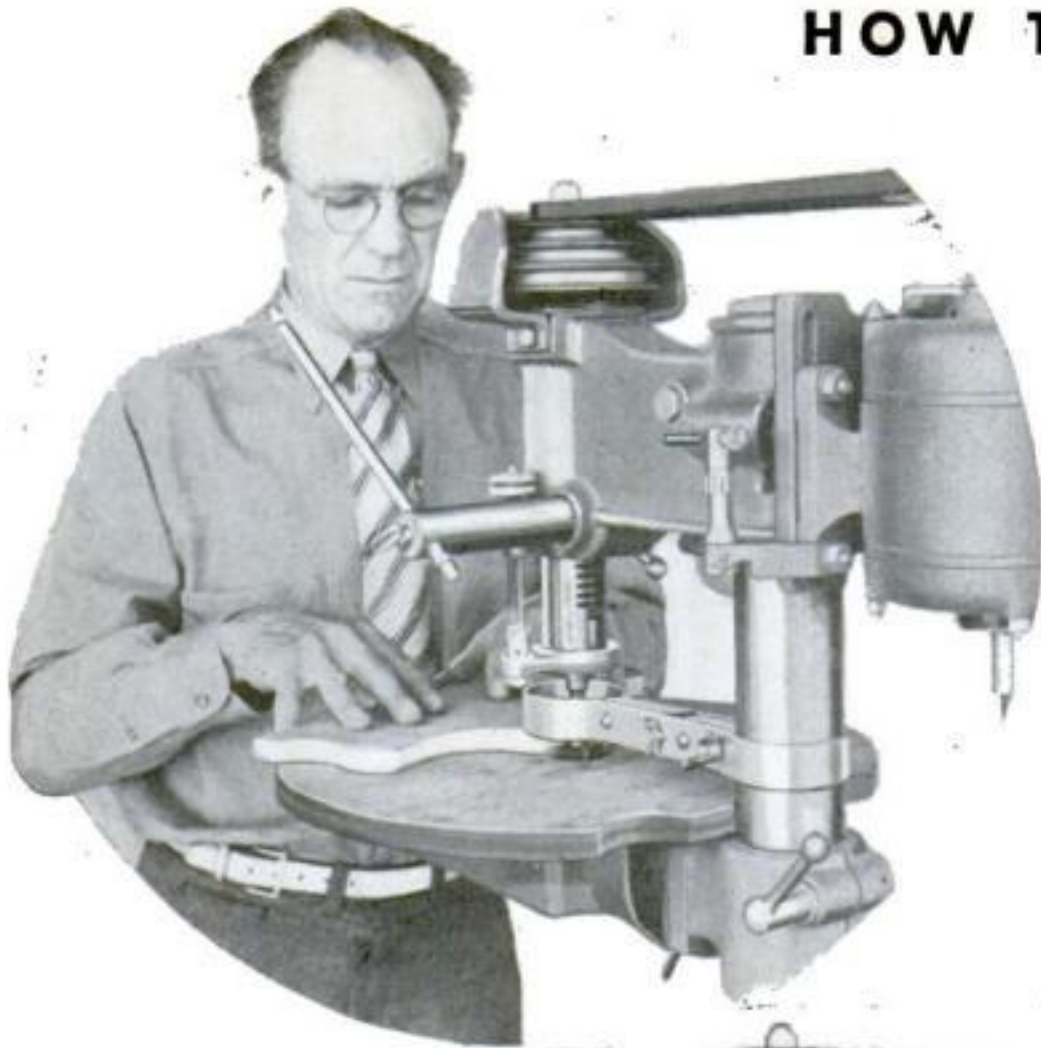
To make rubber tubing, wrap a dowel with cord, dust with talcum powder, and wind on the splicing compound spirally. Then pull out the cord from one end and slip off the tube



Old hold-down rollers on a typewriter will act like new when covered with splicing compound

HOW TO ADAPT YOUR

Drill Press FOR WOOD SHAPING



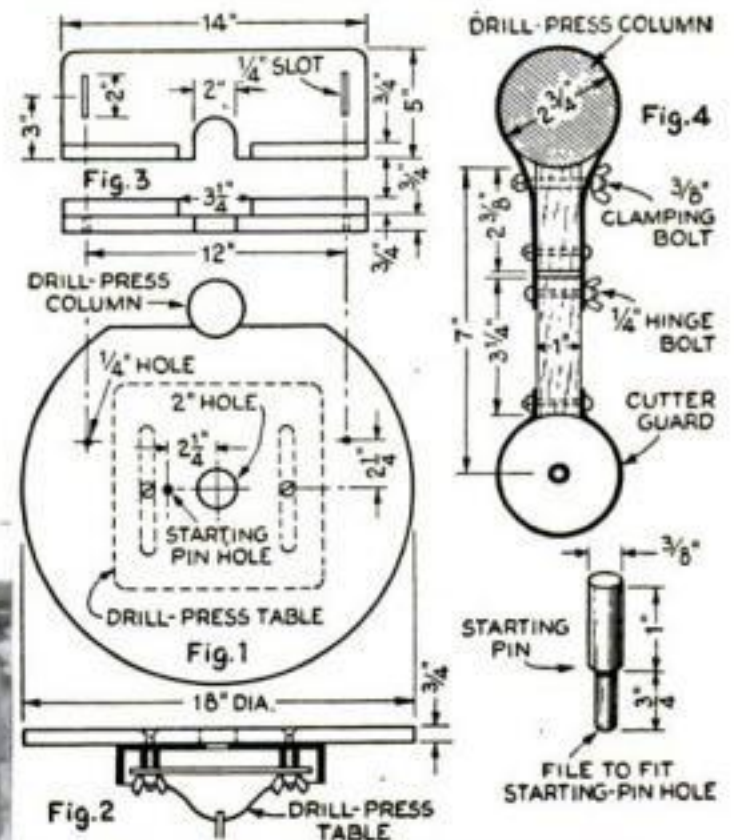
Above, guard in use on free-hand work. It provides complete safety from cutters

EXCELLENT wood shaping can be done on a modern high-speed drill press in the absence of a regular shaper. A special spindle replaces the chuck spindle. This spindle has a shaft to accommodate standard three-lip cutters with a $\frac{5}{16}$ " hole. A set of depth collars and six assorted cutters are then all you will need to turn out a variety of shaped edges.

It is necessary to use the highest speed possible to produce clean, smooth work. Start the cut against the grain to eliminate any torn corners. In free-hand or curved work, a starting pin is necessary to prevent any kick back at the start of the cut.

The table, Fig. 1, is of $\frac{3}{4}$ " plywood, 18" across, and fastened through the slots of the drill-press table with $\frac{1}{4}$ " flathead bolts and wing nuts. Bore two holes in a piece of 1" by 8" by $\frac{1}{8}$ " iron to fit over bolts underneath table to form a clamp (Fig. 2).

The adjustable fence, Fig. 3, is cut from $\frac{3}{4}$ " plywood. A piece of pine $\frac{3}{4}$ " by $\frac{3}{4}$ " by 14" is screwed on top of the front edge and trued with a plane or jointer on the face side. Cut out a $3\frac{1}{4}$ " section in the center. The fence is held in position with two 2" by



The guard is swung out of the way when not required. Left, inserting the starting pin for free-hand work

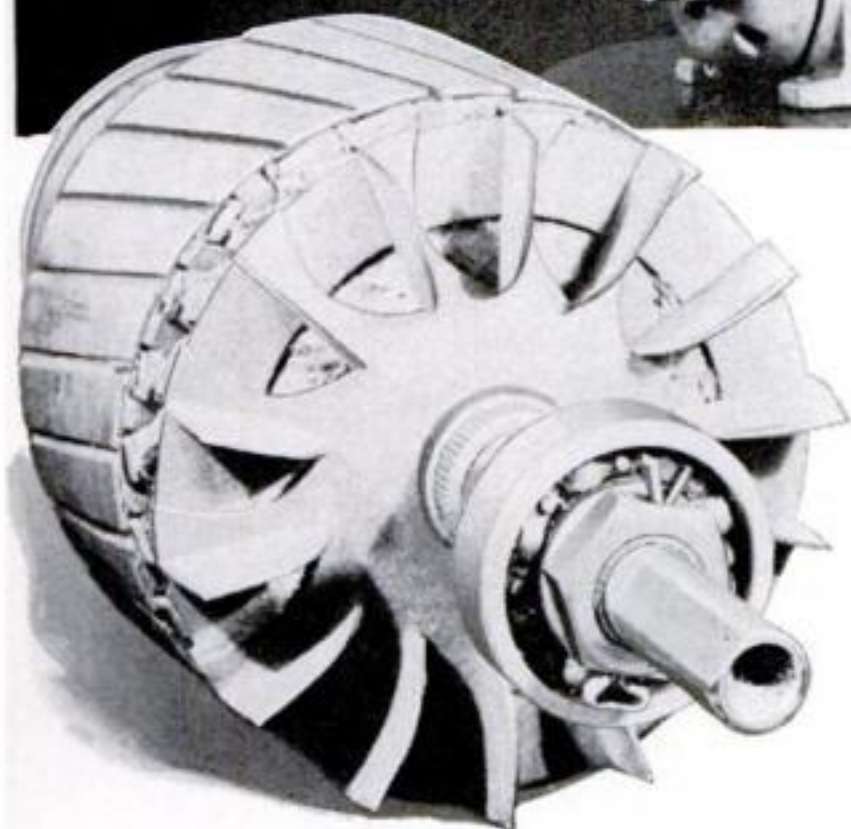
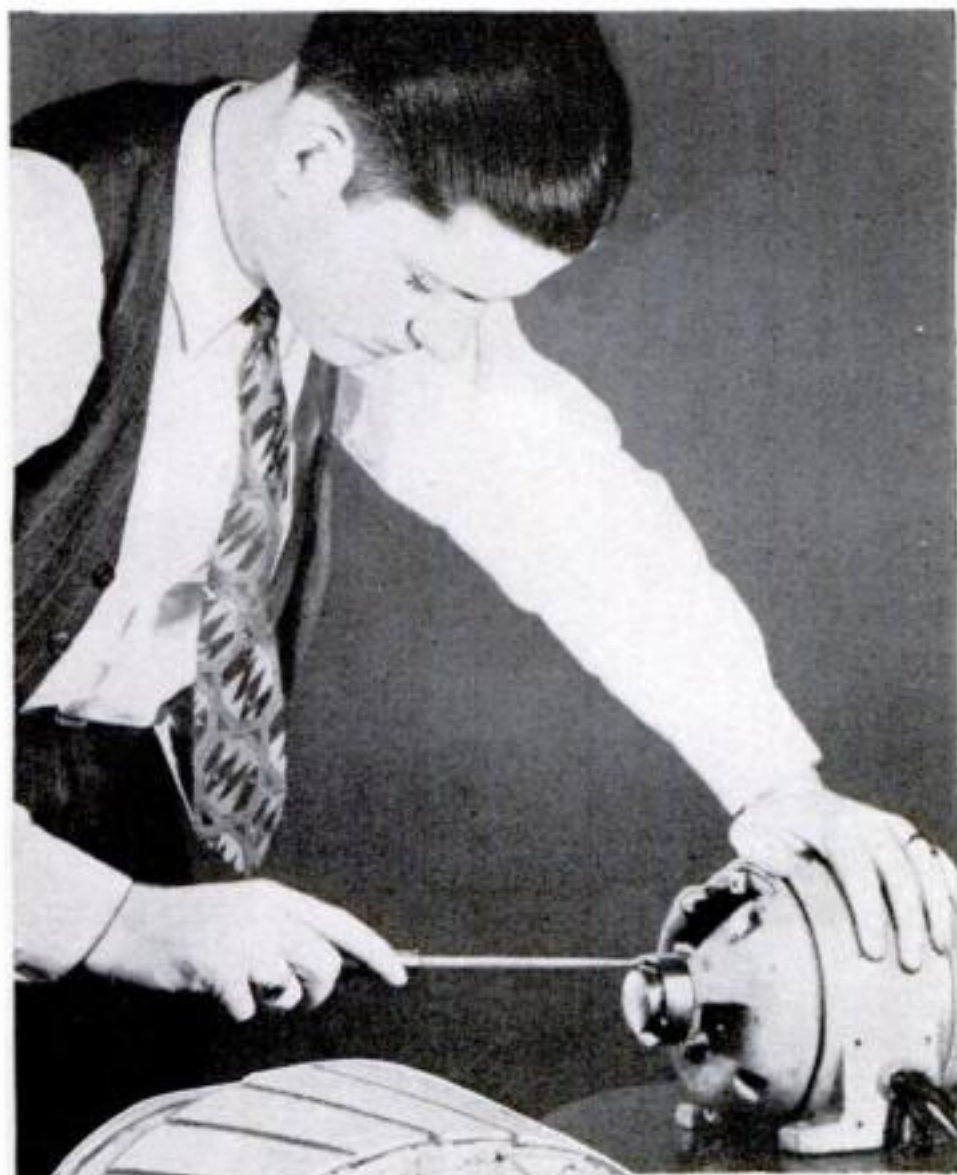
$\frac{1}{4}$ " bolts and wing nuts. Bore $\frac{1}{4}$ " holes in the table to coincide with the slots in fence.

The starting pin can be made from $\frac{3}{8}$ " round iron with one end filed to fit inside a piece of $\frac{1}{8}$ " threaded electric socket tubing 1" long. Bore a $\frac{3}{8}$ " hole in table where indicated, screw in the tubing, and file it flush with surface of table.

An efficient guard may be made of two pieces of 1" by $\frac{1}{16}$ " strap iron, bent to shape shown in Fig. 4, and fastened to separate pieces of maple 1" square. A $\frac{3}{8}$ " bolt and wing nut holds the guard securely to the column. The hinge bolt keeps the cutter up while making adjustments.



new SHOP IDEAS



Upper view, screwing on the dust cap to complete the assembly of a remodeled motor. Second photo shows how bearing on one end is held with a nut

WHEN the sleeve bearings in an electric motor need renewing, it is often easy to replace them with ball bearings by making a few changes. A simple way to do this is to face off part of the motor bells, attach a bushing to this faced-

Ball Bearings

SUBSTITUTED FOR WORN-OUT MOTOR BUSHINGS

• •

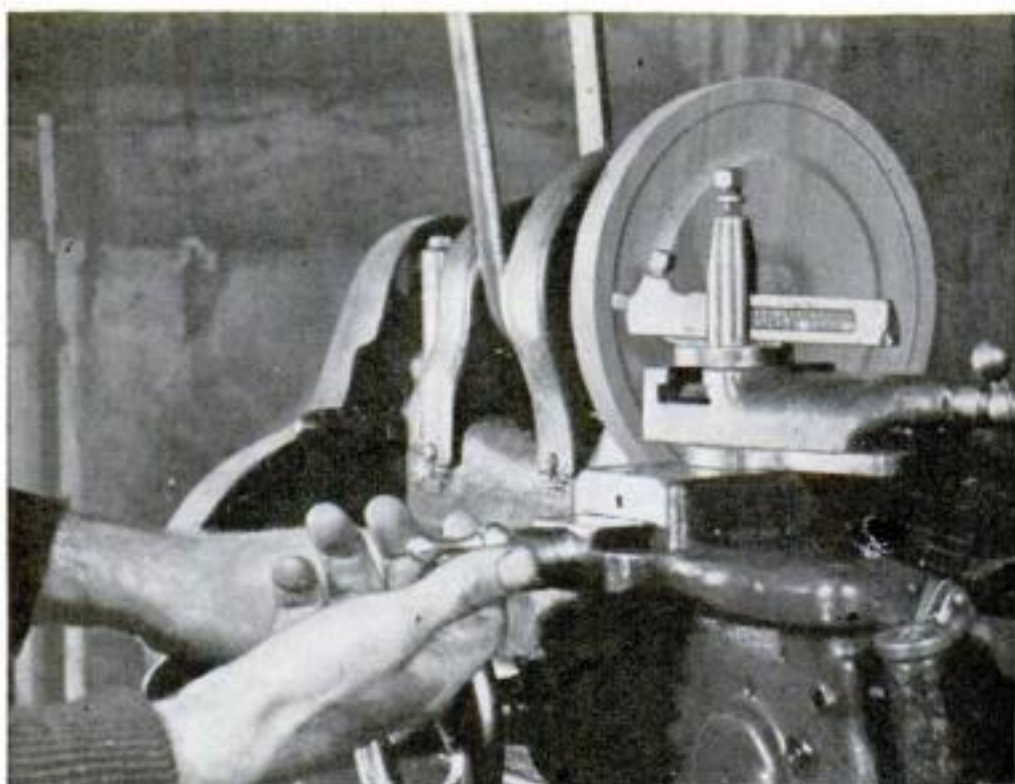
By JOHN COOK, JR.

off part, and then bore out this bushing to take the ball bearing.

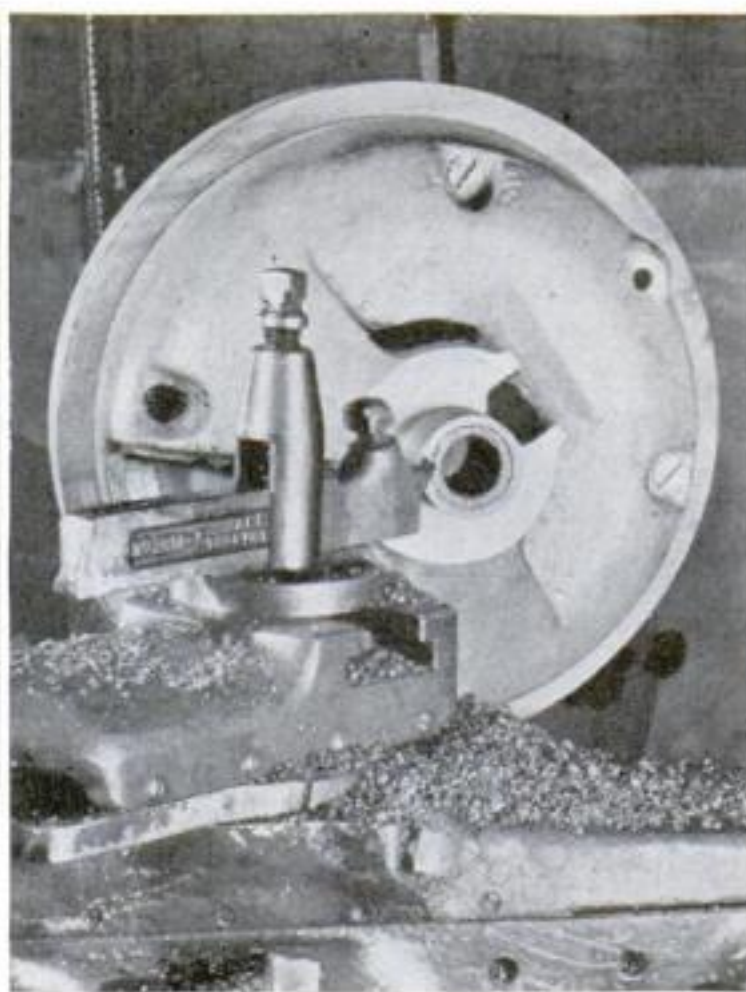
The bells may be chucked so that they will run true by using a wooden mandrel. A piece of hard wood a little larger than the bells and about 1" thick is countersunk on one side to fit the faceplate and attached to it with wood screws. The faceplate holding the wood is then screwed on the lathe, and the wood is turned to fit the rim of the motor bell. If this is a good fit, the bell will run true, and when fastened to the wood with wood screws can be faced without shifting. In the motor shown it was necessary to face off about $\frac{3}{4}$ " of the bells to make room for the bushings to hold the ball bearings. It is very important to leave a shoulder on the face of the bell to hold this bushing in position.

The faceplate with the bell attached is now unscrewed from the lathe, the chuck screwed on, and the bushings made. The bushing is bored out to fit the shoulder on the bell, and the ball-bearing fit is roughed out. Several holes are drilled through the bushing so that it can be fastened to the bell with small screws, and the bell is drilled and tapped to take these screws. Another small hole is also drilled through the bushing and bell for a dowel pin to keep the bushing in its proper position. All this can be done without removing the bell from the faceplate.

After the faceplate has been returned to



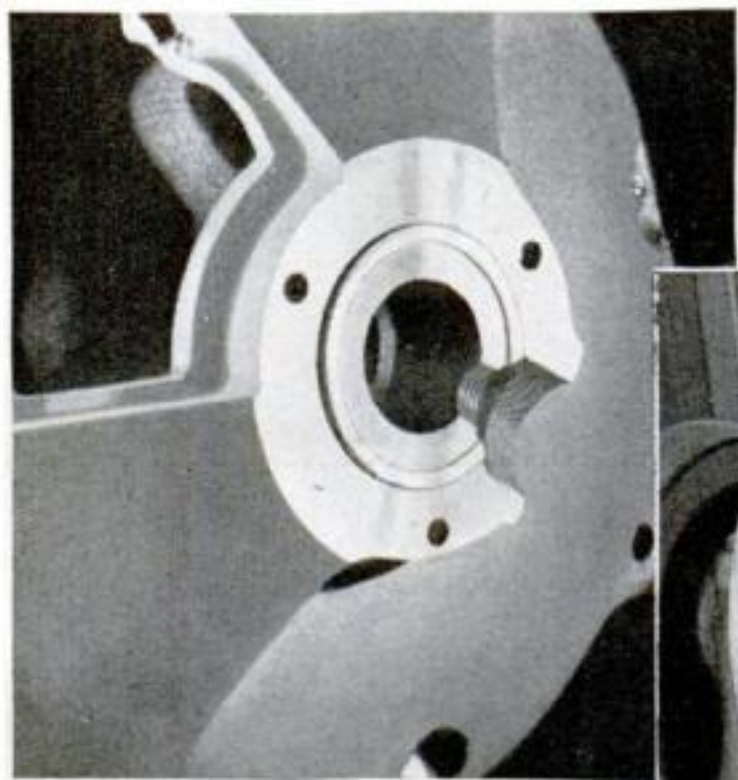
A wooden mandrel is screwed to the faceplate and turned to fit rim of motor bell. Right, the bell is screwed on so it can be faced off to make room for the bushing



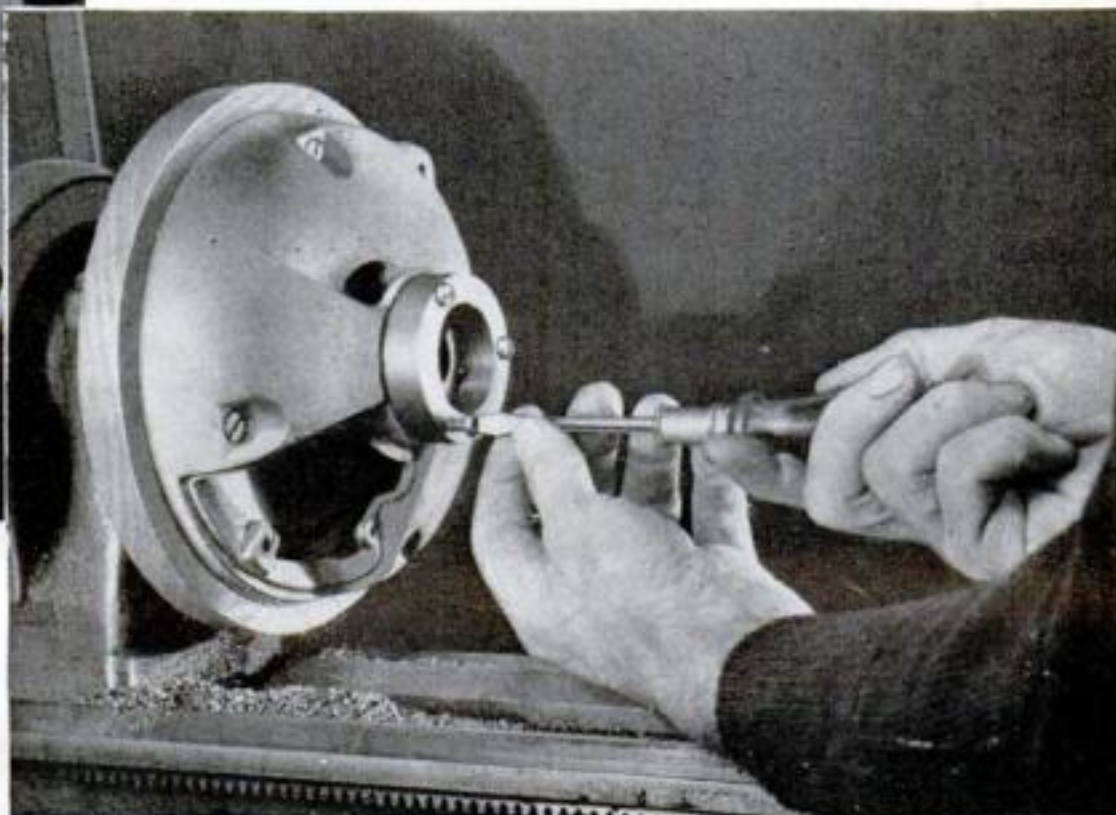
the lathe and the bushing screwed on, the bushing is bored out to fit the ball bearing. Dust caps may be made and held in place by the same screws that hold the bushings, and one of these dust caps can be used to clamp the bearing on one end in place. The other bearing should have a little end play to allow for expansion and any errors in measurement.

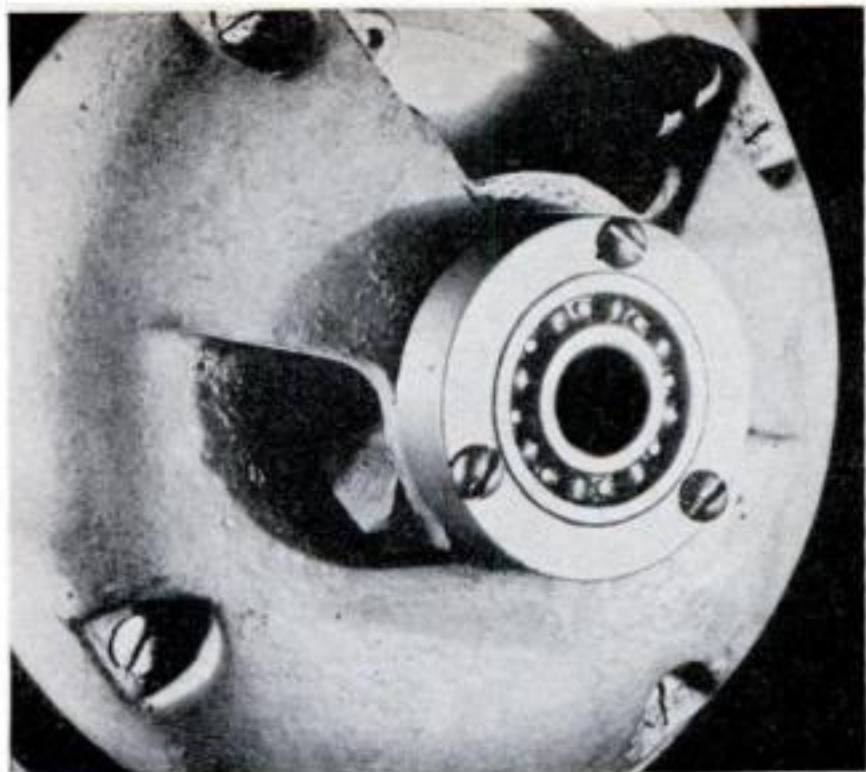
The armature shaft is now turned to fit the ball bearings, care being taken, of course, to place them so that the armature

will run in the proper place. If the shaft is too small for the ball bearings to be used, it is easy to shrink a bushing on each end of the shaft and fit the bearings on these bushings. When turning the fits for the ball bearings, leave a shoulder for both bearings and thread the shaft end for a thin nut to hold the bearing in place. A small cotter pin through this nut and the shaft keeps the nut tight. The bearing on the other end may be held on in the same way, but it is easier to drill and tap a hole in the end of the shaft and hold this bearing on with a washer and a cap screw, which is screwed into this hole. The bearing must stick out over the end of the shaft a little to allow the washer to clamp it against its shoulder. A small hole is drilled through this washer

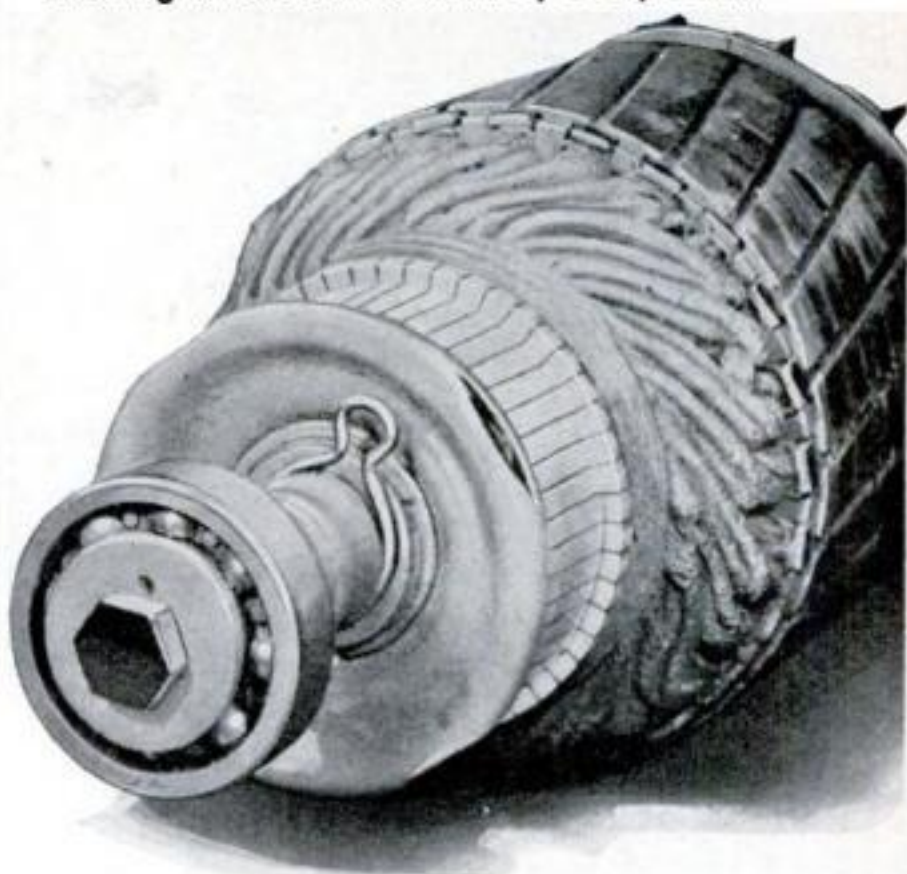


In facing the bell, a shoulder is turned to hold the bushing, which is bored to match. The bushing is also drilled for screws, and holes are drilled and tapped in the bell for the screws so that the bushing can be fastened as shown at right





Left, the bushing is bored out so the ball bearing will fit in. Below, at one end the bearing is held on the shaft by a cap screw



and into the end of the shaft, and a dowel pin inserted to prevent the washer from turning when the motor is running and thus loosening the cap screw. With both the nut and cap screw locked in place, the motor will run in either direction.

For 1/4- and 1/3-h.p. motors, No. 203 ball bearings are a suitable size and may be found in good condition at any automobile junk yard. New bearings are unnecessary.

The position in which the armature runs

must be noted before work is started so that the ball bearings may be mounted in the proper places on the shaft. The bearings should not fit too tightly on the shaft or in the bushings because this would make assembling difficult. The nut and cap screw will hold them tightly in place.

Adjustable Leg Supports Large Work for Planing

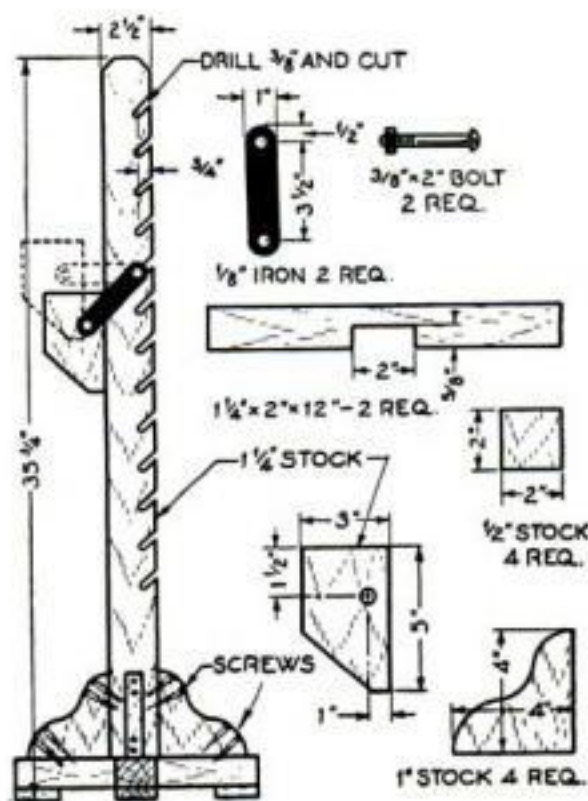


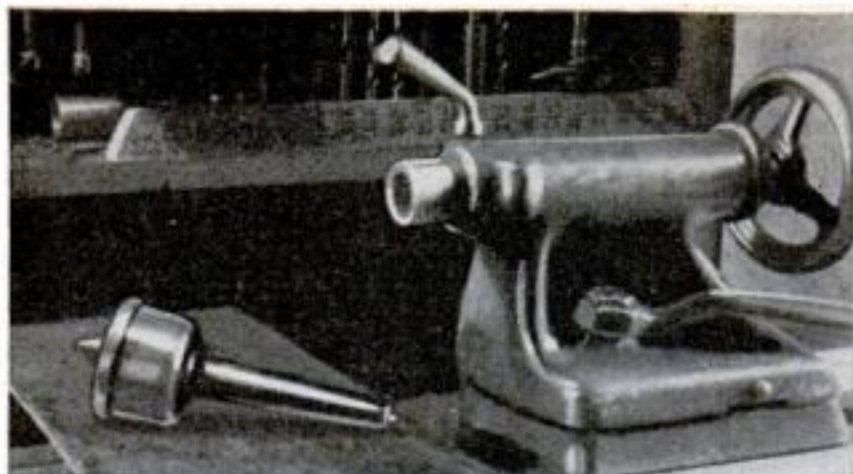
How the support is used to hold one end of a large drawer or any other bulky work

Boards of any length can be planed at the bench by holding one end in the vise and placing the support as shown at the right



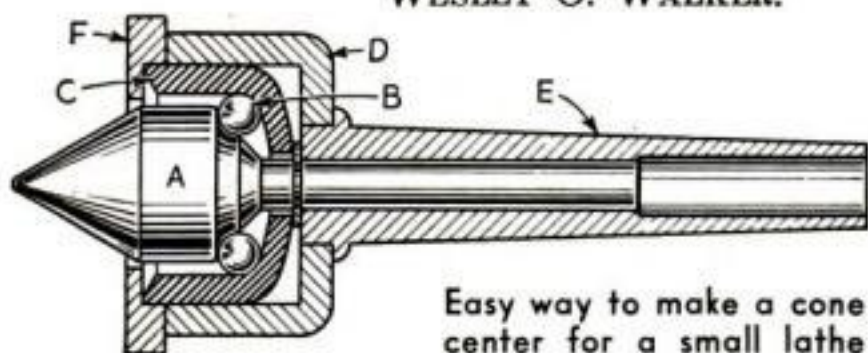
THE "woodworker's slave" is what I call the planing support shown in the accompanying illustrations. It will help hold work of any length or width at the bench. The upright is $1\frac{1}{4}$ " by $2\frac{1}{2}$ " and as long as the bench is high. A series of $\frac{3}{8}$ " holes is drilled along one edge, and slots are cut as shown at a 45-deg. angle. The upright is mounted on a cross-lap base and braced with four wooden corner blocks or iron shelf brackets. An adjustable holder is then made as shown.—RUDOLPH KNAUS, SR.





Ball-Bearing Cone Center Made from Fan Parts

BY UTILIZING the hub and ball-race assembly from the fan of an old automobile cooling system, it is possible to make an excellent cone center for a small lathe. The parts from the fan are marked A, B, and C in the drawing below. A 60-deg. center is turned on the hub A, and the shaft is turned down to make a running fit in a 5/16" hole through E. The latter is turned as indicated to form a Morse-taper shank and pressed into D, which has been bored out to receive the ball-race retainer C. The cap F is made a press fit on C. The whole assembly should be packed with grease.—WESLEY O. WALKER.



Easy way to make a cone center for a small lathe

Old Head Lamp Converted into a Forming Anvil

IN THE garage or small shop, a useful forming anvil may be made by filling a discarded bullet-type head-lamp shell with a rich mixture of Portland cement and sand. Embed one or two 1/2" bolts in the cement before it sets for securing the anvil to the bench top and then allow five or six days for drying. This device is particularly useful for such work as bending copper feed lines to any desired curve, or removing dents from circular metal projects of various sizes.—W. C. W.



Discarded Tap Used as Driver for Recessed-Head Screws

A WORN tap of suitable size, if ground as shown, makes a handy screw driver for recessed-head screws when a set of screw drivers intended for this special type of screw is not at hand.



PIPE DIMENSIONS

[METAL WORKING]

Nominal Inside Dia.	Actual Outside Dia.	Actual Inside Dia.	Nominal Inside Dia.	Actual Outside Dia.	Actual Inside Dia.
1/8	0.405	0.270	3	3.5	3.067
1/4	0.540	0.364	3 1/2	4	3.548
3/8	0.675	0.494	4	4.5	4.026
1/2	0.840	0.623	4 1/2	5	4.508
3/4	1.05	0.824	5	5.563	5.045
1	1.315	1.048	6	6.625	6.065
1 1/4	1.66	1.38	7	7.625	7.023
1 1/2	1.9	1.61	8	8.625	7.982
2	2.375	2.067	9	9.625	8.937
2 1/2	2.875	2.468	10	10.75	10.019

Note: Dimensions above are in inches, and are for standard steel and wrought-iron pipe.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

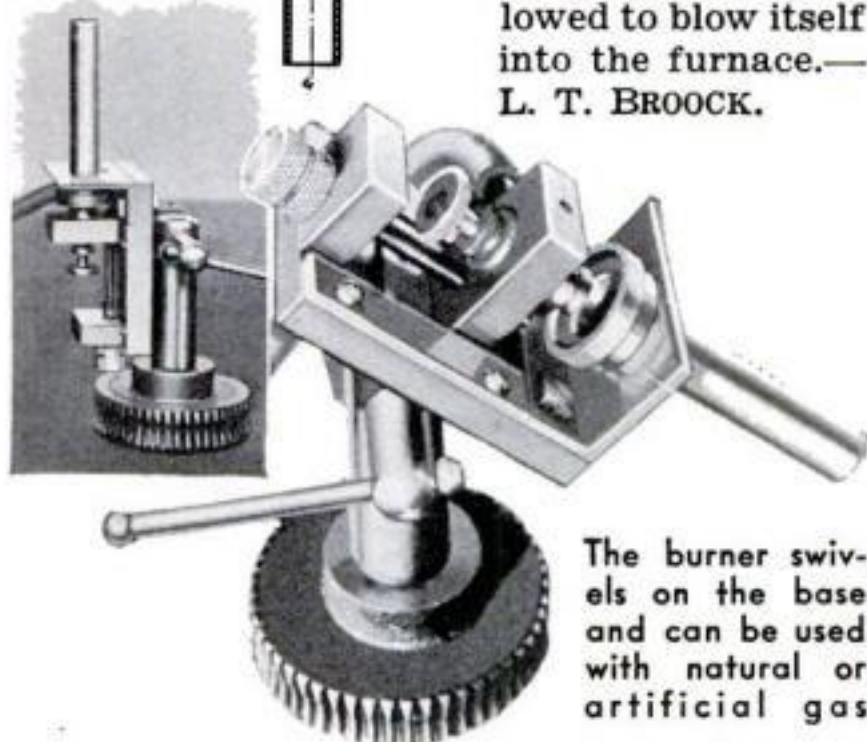
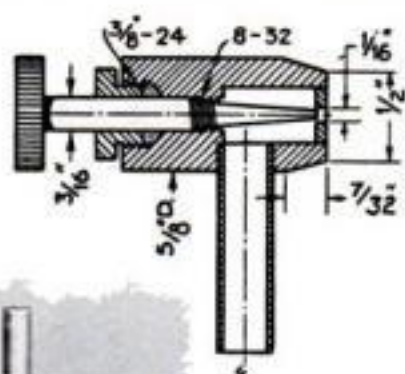


Universal Shop Burner for Tempering Tools

PRACTICALLY every owner of a metal working lathe has need for a furnace to aid in hardening and tempering tools. The furnace illustrated, which was constructed from odds and ends of metal found about the shop, gives ample heat without compressed air. A small steel tool can be brought to a cherry red in a few minutes.

The construction of the burner is illustrated in the photographs, except for the gas adjustment, which is shown in the detail drawing. Both the air and the gas are adjustable so that the burner can be used with either natural or artificial gas. In a vertical position it can be used as an ordinary Bunsen burner.

The furnace, shown above, consists of an ordinary tin chalk box lined with a mixture of fire brick and plaster of Paris. The flame from the burner is allowed to blow itself into the furnace.—L. T. BROCK.



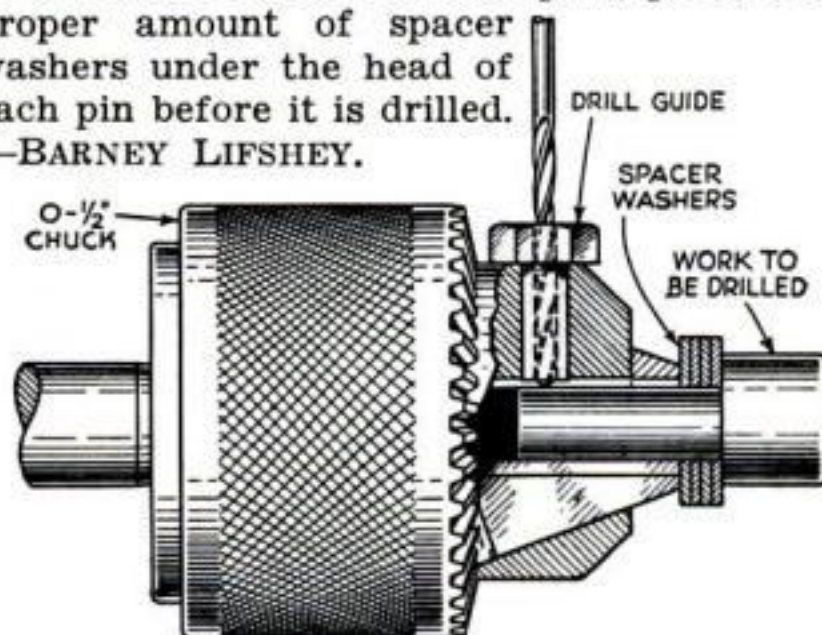
The burner swivels on the base and can be used with natural or artificial gas

Drill Chuck Acts as Jig for Holding Metal Pins

SMALL holes, such as cotter-pin holes, can be drilled exactly through the center of small rods and pins by using a geared 0-1/2" drill chuck as a jig. First, a drill guide must be made from a 5/16" cap screw, cut to the proper length and drilled through the center with same size drill that will be used later.

The pin to be drilled is clamped in the chuck, and the drill guide is inserted into one of the three holes that act as the pilot for the chuck key. The drill is now run through the pin until the end just about touches the hardened jaw opposite. The pin is then removed from the chuck, and it is a simple matter to finish the drilling. In order to drill a series of identical pins, place the proper amount of spacer washers under the head of each pin before it is drilled.

—BARNEY LIFSHEY.



The drill guide is inserted in a chuck-key hole

Cleaning an Electric Clock

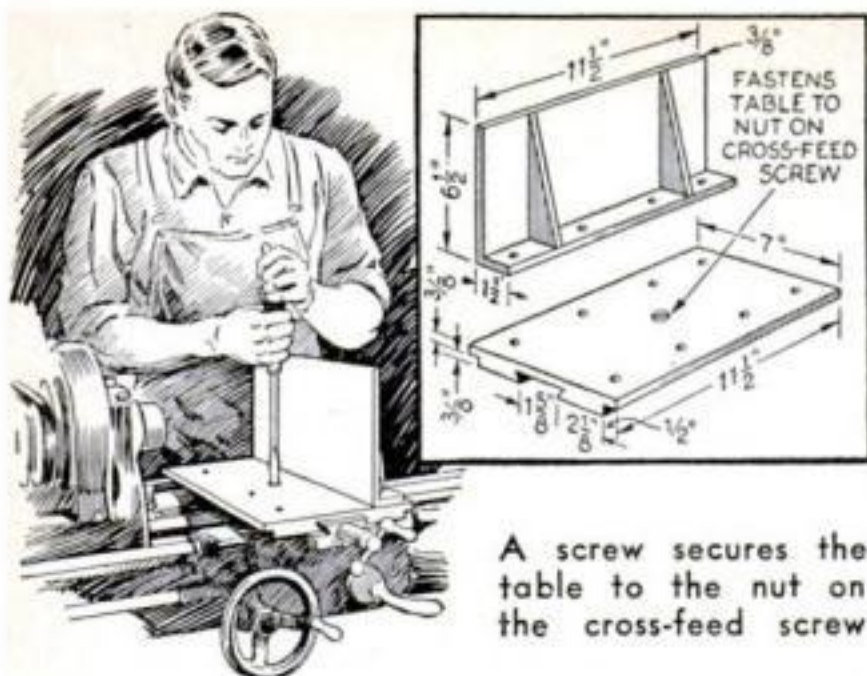
WHEN an electric clock stopped recently, no amount of adjustment would start it. Finally the works were removed and drenched in carbon tetrachloride to wash out dust and dirt in the gears. It has functioned perfectly ever since.—M. W. H.

Small Aluminum Strainer Skims Slag from Solder

A FAIRLY deep aluminum top from a discarded salt or pepper shaker, if fitted with a metal handle, makes a good strainer for removing the scum or slag from a pot of molten solder or lead, or for skimming off various impurities from liquid soldering flux.—W. C. W.

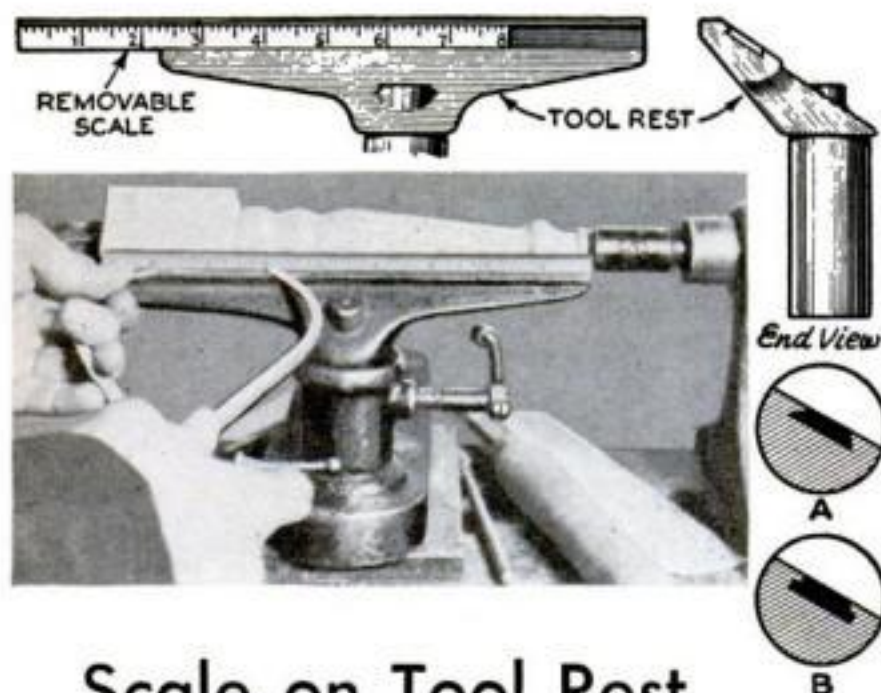


If corrosive fluxes are strained with the aluminum shaker top, rinse it thoroughly in water



Boring and Milling Table Fastened to Lathe

THIS boring and milling table replaces the cross-feed assembly of a small lathe and supplies a rigid table to which work may be bolted. The table is made of cast iron with all surfaces planed. A screw secures the table to the nut on the cross-feed screw, and the V-way is provided with a gib and the necessary tightening screws. An angle plate, also of cast iron, may be bolted to the front or rear edge of the table as the work requires.—WESLEY O. WALKER.



Scale on Tool Rest Speeds Wood Turning

WOOD turning may be speeded up and measurements more accurately scribed on the wood when the tool rest is graduated. A plain slot was milled across the beveled surface of the tool rest shown about $\frac{1}{4}$ " below the top horizontal surface. A scale was cut to fit and cemented in the groove.

Some lathe manufacturer could do wood turners a favor by designing tool rests to hold a scale, as shown, so that scales could be interchanged.—E. C. H.

Cold-Rolled Steel Clamps Hold Small Materials

ALMOST any type of small work can be held with these easily made clamps and they are especially useful to model makers. The clamps stand up very well under heat when used to hold work for soldering or light brazing.

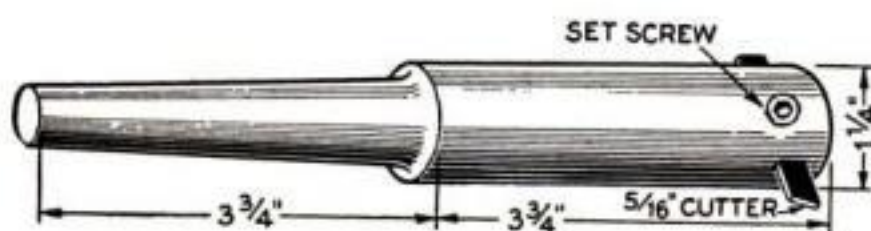
The body is formed of cold-rolled steel, turned or filed to shape. Holes are drilled and tapped for the clamp screws, which are shaped from small carriage bolts with the heads filed square.—H. R. H.



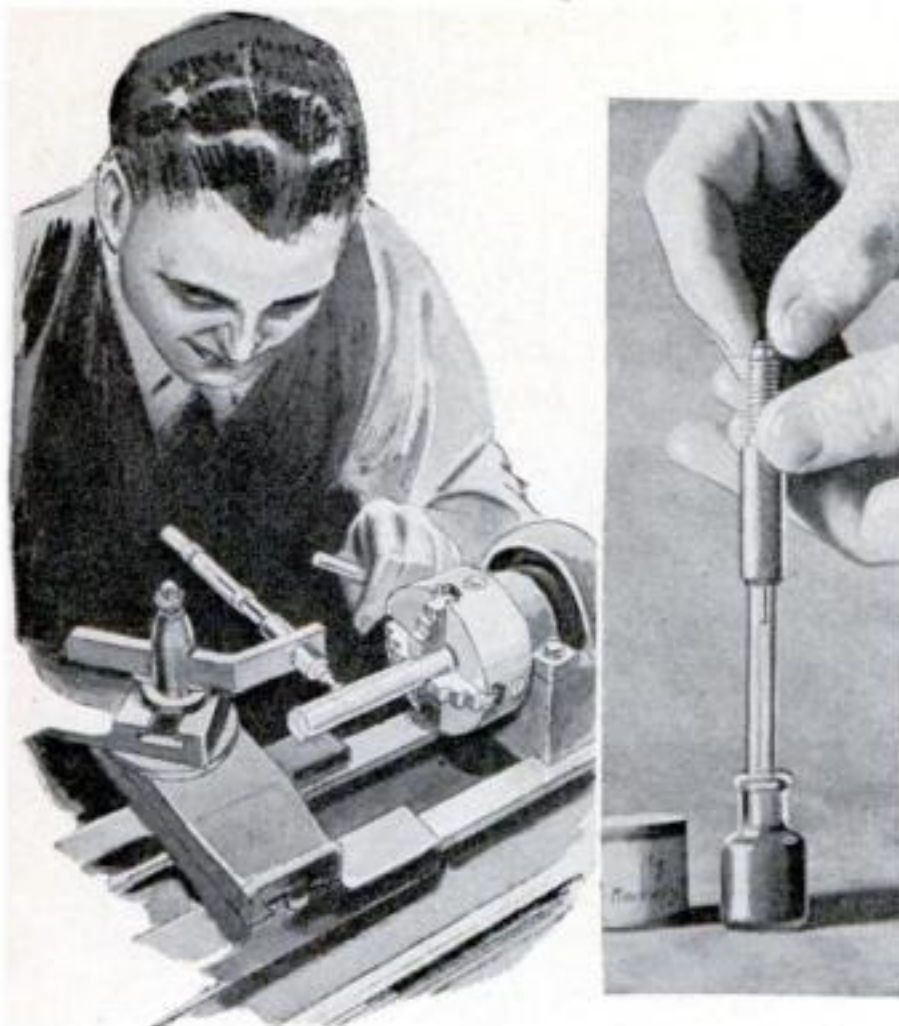
The clamps will grip many small shapes and are unharmed by the heat of brazing and soldering

Spindle Tool Bores Work That Cannot Be Swung

WORK that cannot be swung in the lathe may be fastened to the carriage and bored with this tool. Certain types of milling may also be done; for example, a tool with a 60-deg. point will cut V-ways in steel. The tool is made from cold-rolled steel. One end is turned to a No. 3 Morse taper to fit the spindle of the lathe, and a $\frac{5}{16}$ " square hole is broached through near the other end. A $\frac{5}{16}$ " cutter is held by a headless set screw.



Mercury Indicator for Centering



Using the indicator to center work in a four-jaw chuck and, to the right, filling the indicator

FOR the owner of a small metal-working lathe, this accurate indicator is a novel and useful project. The body is threaded so it may be fitted to any type of holder; it can thus be used for various other purposes besides centering lathe work.

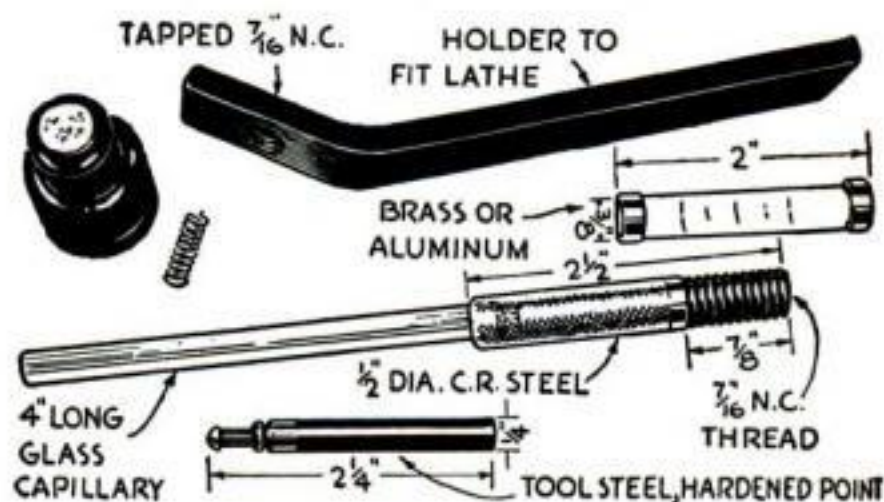
Thread and knurl the body first; then protect the finished surface while it is gripped in the chuck for drilling the holes. The $\frac{1}{4}$ " hole for the plunger should be reamed to size or lapped to a fine, smooth finish. Obtain a steel spring that will just fit this hole. Use tool steel for the plunger so the

end can be hardened. Polish, lap, or grind it till it makes an easy sliding fit in the body.

The glass capillary tube is cemented in the large hole at the back of the body. The holder, which must be made to fit the tool post of your lathe, is tapped on one end to receive the indicator. Do not use brass for any part of the indicator.

Grease the plunger with heavy oil and insert it in the body after dropping in the spring. Suck the mercury up by inserting the indicator into a bottle of mercury and pulling out the plunger; then remove, turn upside down, keep pulling out the plunger far enough for the mercury to get out of the capillary, and push it back. Repeat this process until the mercury shows a plus and minus reading about midway along the capillary as the plunger bears on the spring.

Calibrate a scale by finding how far the mercury travels when compared with a known standard. A scale can be made by scratching fine lines on a piece of aluminum or brass bent to fit over the glass capillary.

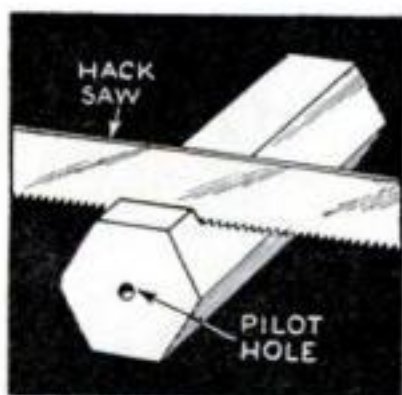


Parts of the indicator before assembling. The body is made from a piece of cold-rolled steel

How to Make Small Nuts of Odd Sizes

IN EXPERIMENTAL work it is often necessary to make a few small, odd-sized nuts. One method is to drill a length of "hex" stock, tap it as deep as possible, and after cutting off the nuts immediately needed, mark and store the remainder for future use.

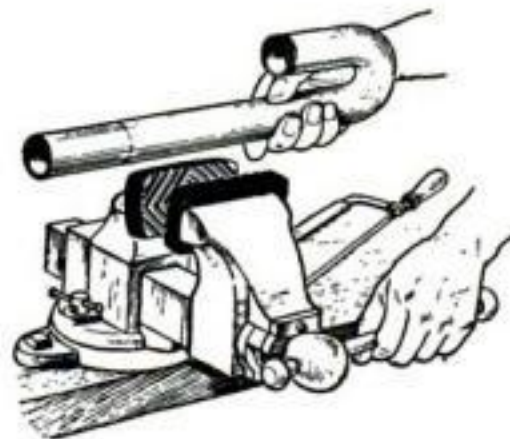
A second method is to drill a fine pilot hole through the piece and cut off and tap what is needed. If another size is required later on, it is an easy matter to enlarge the pilot hole to the tap-drill size.—S. J. G.

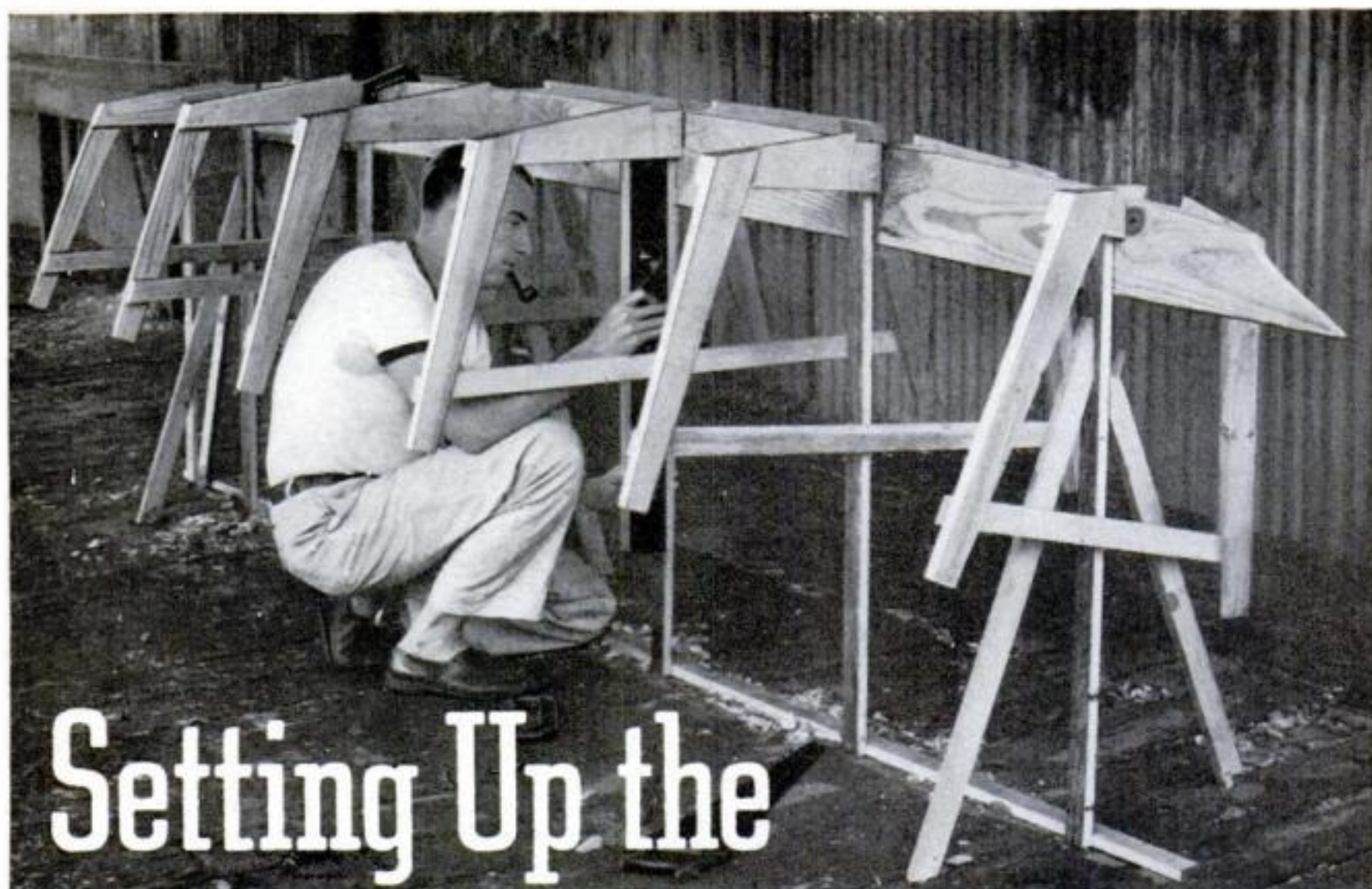


Rubber Brake-Pedal Pads Used on Vise Jaws

A PAIR of rubber brake-pedal pads, which can be bought for a few cents at an auto accessories store, can be used to cover the jaws of a machinist's vise, as shown, so that soft or polished material can be gripped without being marred.

If the rubber pad is a trifle too small, a few slits in the back with a knife will probably make it fit snugly over the jaw of the vise.—R. W.





Setting Up the

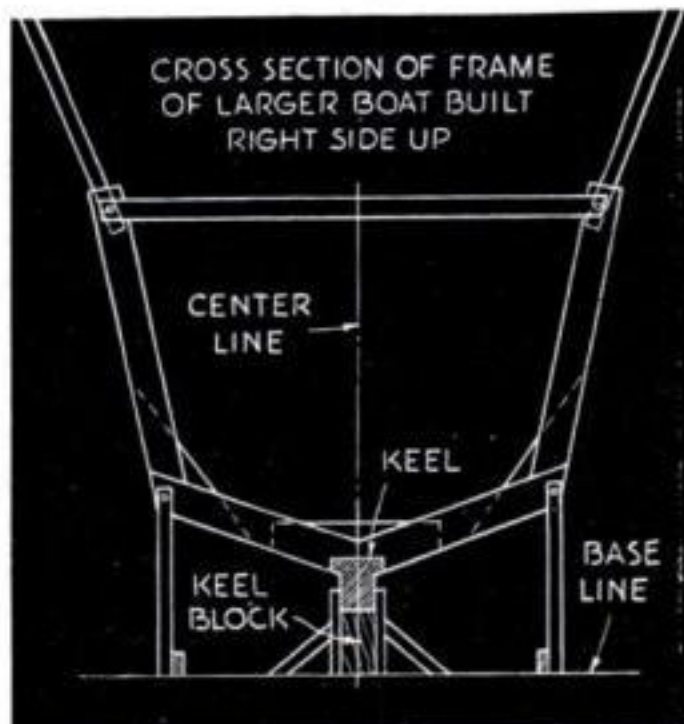
Frame of a Small Boat

AFTER the stem, frames, and transom of a small boat have been assembled, the problem comes of setting these parts up and bracing them. In general there are four ways of doing this. The boat may be set up right side up or upside down, and with or without the use of a keel form.

Boats under 20' in length are usually more easily built upside down. The use of a keel form will assure the correct curve to the keel line. Notches are cut in the keel where the frames will rest, and uprights are fastened to it at each station, next to the frame notch. Then the keel form should be set up at a convenient height for working, well braced to the floor, or to some other support if the boat is built outdoors. The uprights should be perfect-

By
**BRUCE and
WILLARD
CRANDALL**

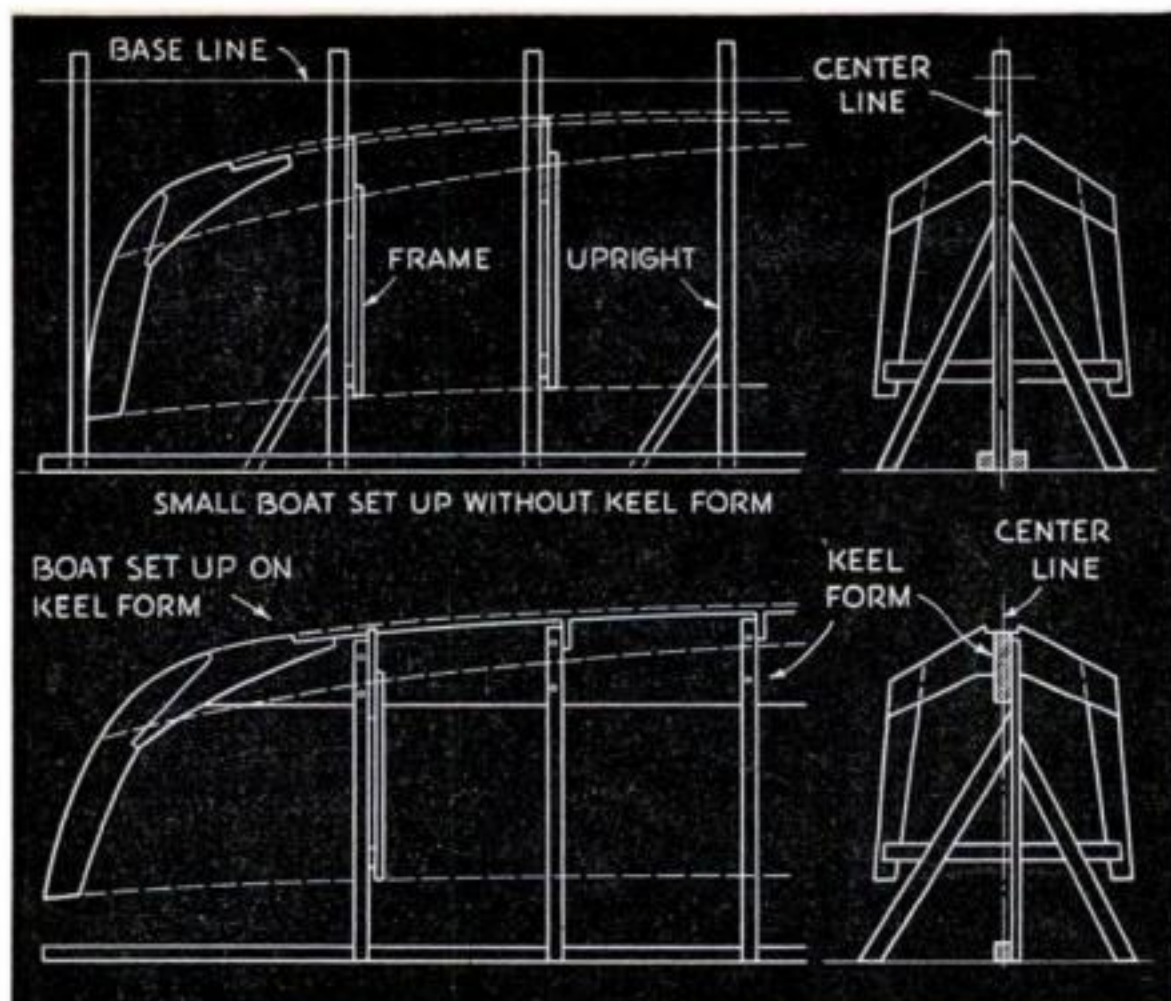
ly plumb and at right angles to the keel form. The frames are set in the notches and temporarily fastened to the uprights in such a way that their center lines are perfectly plumb and at the center of the keel form.



How the frame of a large boat is set up on keel blocks and braced from both the floor and the rafters above. The large photo shows the use of a notched keel form for holding frames upside down

The keel or keelson, stem, and transom are next set up and braced in position. After making sure that the stem and transom are in line, check each frame to see that it is at right angles to the keel form before the chine pieces are put in. The side frames are also checked to make sure they are plumb before the sheer batten or any side planks are put in place.

If the boat is built upside down without the use of a keel form, the uprights are put up first, braced from the floor at each station. Make sure they are perfectly in line.



Two methods of upside-down assembly, with and without a keel form

The center of these uprights will then coincide with the center line of each frame. Stretch a cord or wire across the top of the uprights to represent the base line, and fasten each frame to the upright at the proper distance from the base line. It is then necessary to take accurate measurements to be sure of the correct placing of the stem and

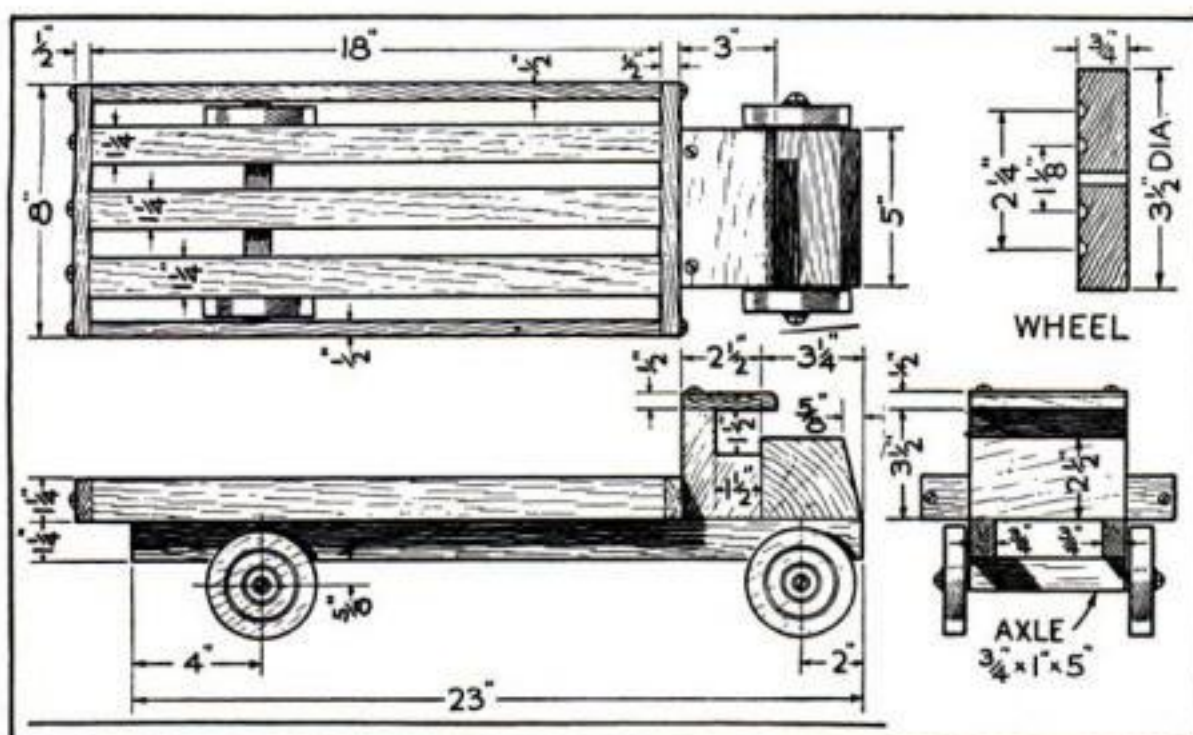
transom. The parts of the uprights which extend above the frames must, of course, be sawed off before the keel or keelson can be put in position.

If the boat is built right side up, the keel can rest on a keel form, or on keel blocks in the case of a large boat. The floor can be used as a base line if it is perfectly straight; otherwise a wire may be stretched to serve the purpose. The keel, stem, and transom are put in position first, care being taken that the stem and transom center lines are perfectly plumb; then the frames are set in place and braced, preferably from above to the rafters of the building.

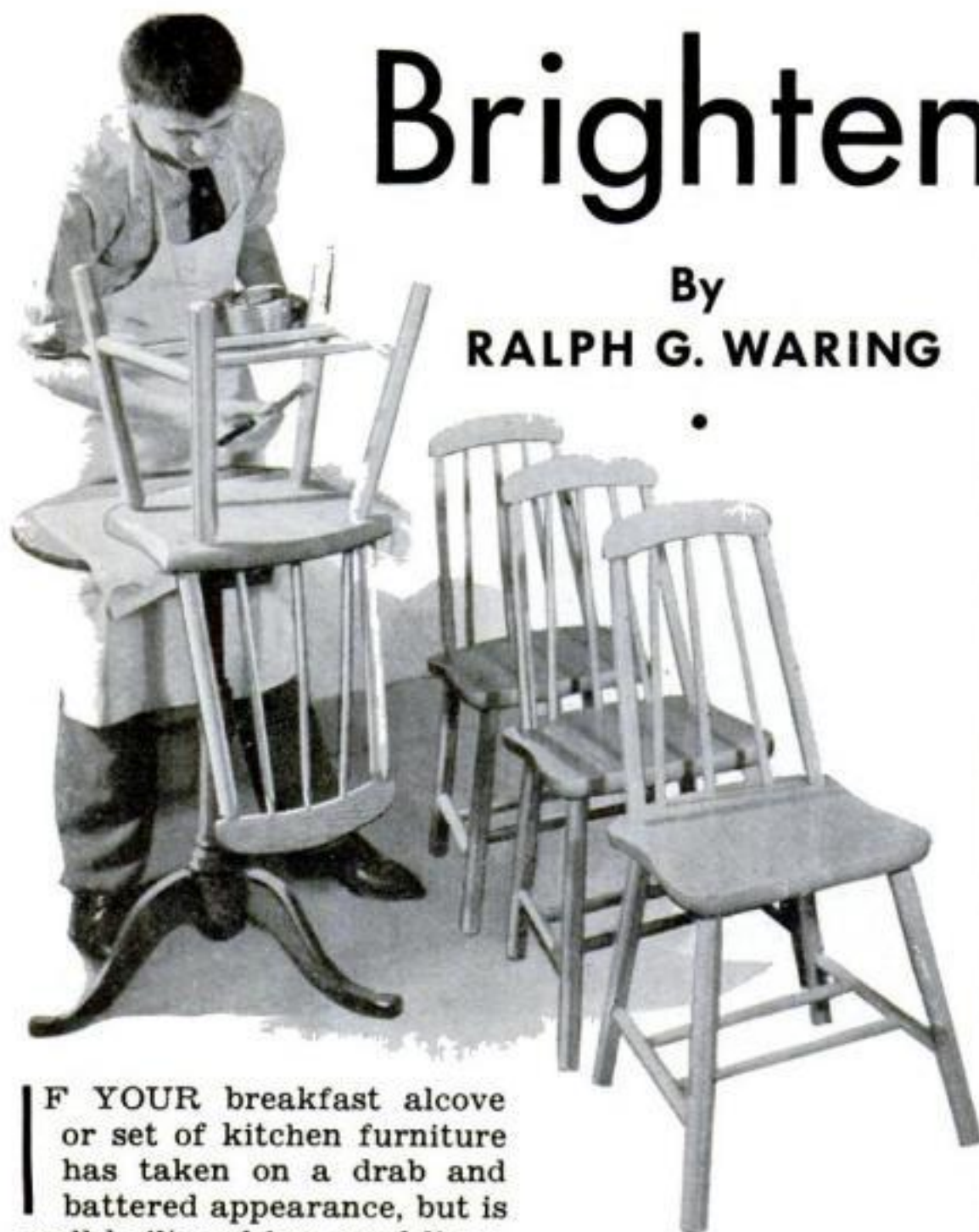
After all the framework has been properly braced, it must be carefully trued up by eye and also with a bending batten, clamped over the framework at various points. This will reveal any slight mistakes in the shape of the frames or in the position in which they are set up. Each frame and the transom must also be properly beveled so that the planking will all fit perfectly.

Sturdily Built Toy Truck Holds a Small Child

A SMALL boy always appreciates a toy truck that is large and substantial enough for him to ride on himself. The truck illustrated is of this type and correctly proportioned for children from eighteen months to three years of age. The chassis consists of two strips $\frac{3}{4}$ " by $1\frac{1}{4}$ " by 23" joined by the cab, hood and axles. The cab roof is a piece $\frac{1}{2}$ " by 3" by 5", with the grain parallel to the chassis. The bed is made of five rails and two end pieces.—G. GREEN.



The truck is an attractive toy especially if chassis, cab, and hood are enameled a bright red, with yellow bed and black wheels



Brightening Up

By
RALPH G. WARING

needed. Use steel wool and alcohol to take off the final traces of old finish. Let dry overnight.

Breakfast finishes are of two kinds: Solid color enamel and shade-coat or high-lighted finishes that only partially cover the wood, which becomes a part of the color scheme. The enamel work can be done with brush or spray gun. The high-light finish is best done with the gun.

ENAMEL. Sand wood with No. 3/0 garnet paper. Dust and apply a sealing coat of four-hour floor varnish reduced 50-50 with pure turpentine. Do not use shellac. Let dry overnight. Sand with either the previously used and well-worn No. 3/0 paper or with No. 6/0 garnet finishing paper. Dust off and follow with a tack rag.

Turn each chair upside down and coat the underframe evenly. Replace right side up and complete the underframe, then the back frame and headrail, and last of all the top face and edges of the seat. Place the hand palm up beneath the seat and lift the chair down out of the way. Use a similar method on all the pieces. Dry two days.

IF YOUR breakfast alcove or set of kitchen furniture has taken on a drab and battered appearance, but is well built and has good lines, it can be refinished to look like new.

In most cases No. 2 steel wool and denatured alcohol will remove the old finish. If it is stubborn or alcohol resistant, however, a standard varnish remover will be

back frame and headrail, and last of all the top face and edges of the seat. Place the hand palm up beneath the seat and lift the chair down out of the way. Use a similar method on all the pieces. Dry two days.

STANDARD FILLER STAINS

[PAINTING]

1. Make up or buy an oil stain of the required color.
2. Add 10 to 12 lb. of natural paste wood filler per gallon of oil stain; then add 1 pt. linseed oil per gallon. Keep stirred. Oak, mahogany, and walnut stains require more paste than closer-grained woods such as birch.
3. Apply to wood, let gloss of vehicle flatten off, then pad in with 12" burlap squares. Clean off with rags across grain. Wipe lightly with the grain at end of filling operation. Inspect carefully for remaining smears and traces of filler left near moldings and corners. Remove any such filler with a wooden picking stick sharpened like a pencil on one end and a chisel on the other, and covered with a rag.
4. Dry 48 hours in a warm room before finishing.

POPULAR SCIENCE MONTHLY SHOP DATA FILE

a Breakfast Set

Sand lightly with old No. 6/0 paper. Tack-rag off and recoat with enamel. Let dry two days. If a little contrasting color is desired, as black or scarlet with ivory body, use on one upper bead only.

HIGH-LIGHTED OR SHADED. Strip all pieces to the wood. Dry twelve hours. Sand with No. 3/0 garnet. Dust off. Spray on a clear coat of wood lacquer reduced with two parts of thinner. Dry hard and sand with No. 6/0 garnet.

Mix colored lacquer enamel—ivory, green, pearl gray, or any soft, pleasing color. (Use strong colors for *tiny* touches of decoration, if desired.)

Set fluid feed control down to a minimum and adjust width of spray to 1" or more at 18" from spray tip. Shade-coat work is applied at twice the normal working distance, and a minimum of paint material is used.

Let dry three hours. Sand high lights lightly to correct any overspray. Use No. 6/0 garnet finishing paper moistened on back.

Spray the table top and frame lightly with fogged-on color, but strictly avoid a spray pattern. Allow less grain to show here. Dry table and frame hard and then sand out as needed to get a satisfying blend between finish color and wood. Dust and tack off carefully.

Spray on a light, *wet* coat of clear wood lacquer reduced half and half with thinner.

Dry and give chair rails, seats, and table top a second coat. Dry overnight. Make up a pad of No. 2/0 steel wool, load with a good grade of floor wax, and rub the table top and edges in one direction only, just enough to smooth off any dust nibs. Avoid cutting through. Repeat this process on chair headrails and seat top. Dry one hour and polish with a pad of cotton flannel.



Scraping off old finish after using varnish remover

ENAMELING OVER MAHOGANY STAIN

[PAINTING]

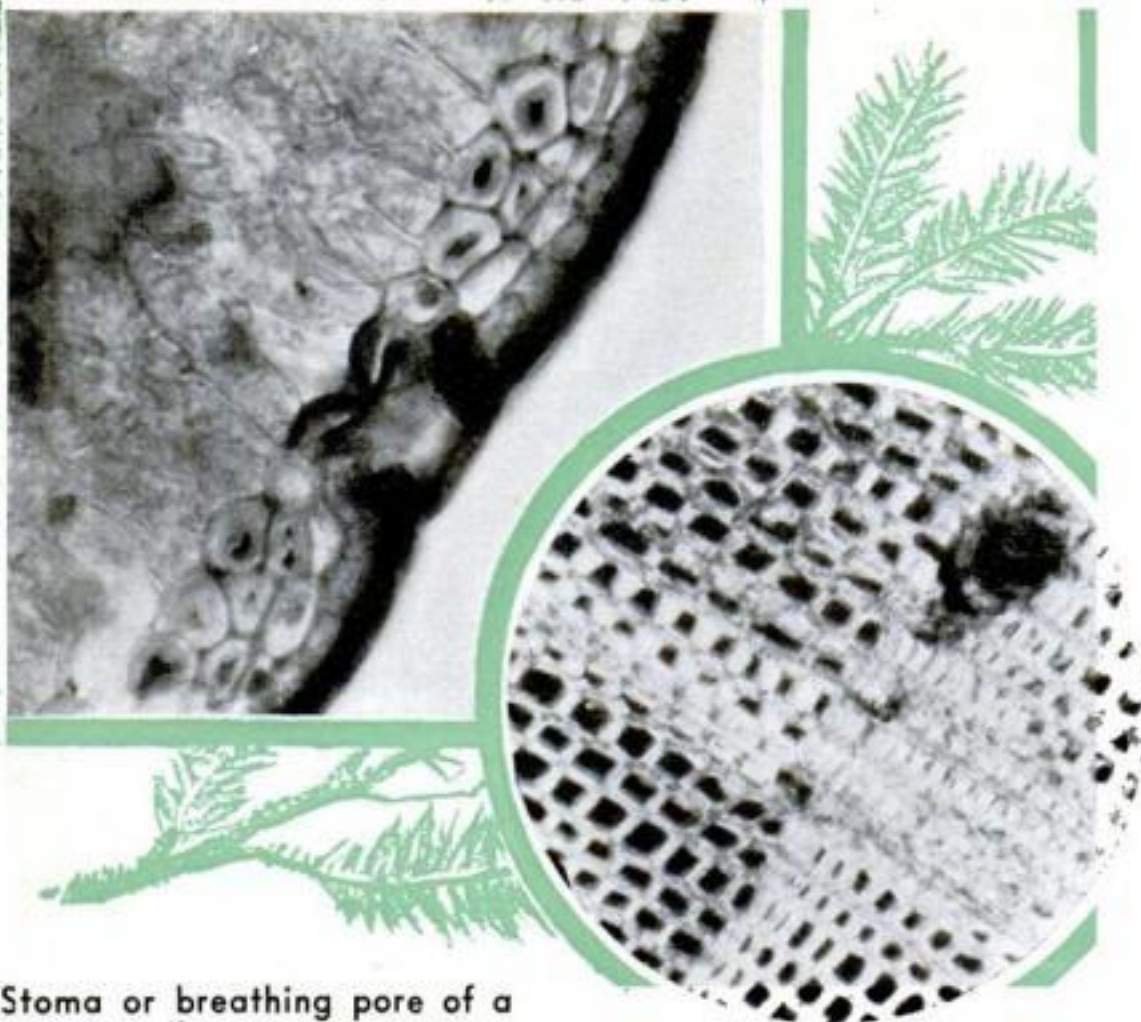
Woodwork that has been finished with mahogany stain, especially of the penetrating red type, is difficult to refinish with enamel because of the tendency of the stain to bleed through and discolor any number of coats. To overcome this, proceed as follows:

1. Strip the mahogany-finished door, closet seat, mirror frame, or other piece down to the bare wood with varnish remover. Scrub with steel wool and denatured alcohol. Wipe clean with rags and alcohol.

2. Dry one hour, sand with 4/0 garnet paper if necessary, then coat thinly and evenly with freshly mixed aluminum or gold bronze paint. The type that has paste or dry aluminum bronze in one section of the can and clear liquid in the other is the best to use.

3. Dry hard, then proceed with undercoater and enamel coats in the usual way. Sand the first coat of undercoater level and smooth before enameling.

POPULAR SCIENCE MONTHLY SHOP DATA FILE



Stoma or breathing pore of a pine needle in cross section. Right, typical wood structure

IF SANTA CLAUS leaves a microscope in your stocking, you can start your exploration of Microland as soon as all the gifts have been unwrapped. And, even if you are already a veteran lens enthusiast, the holiday season offers many new subjects worthy of examination.

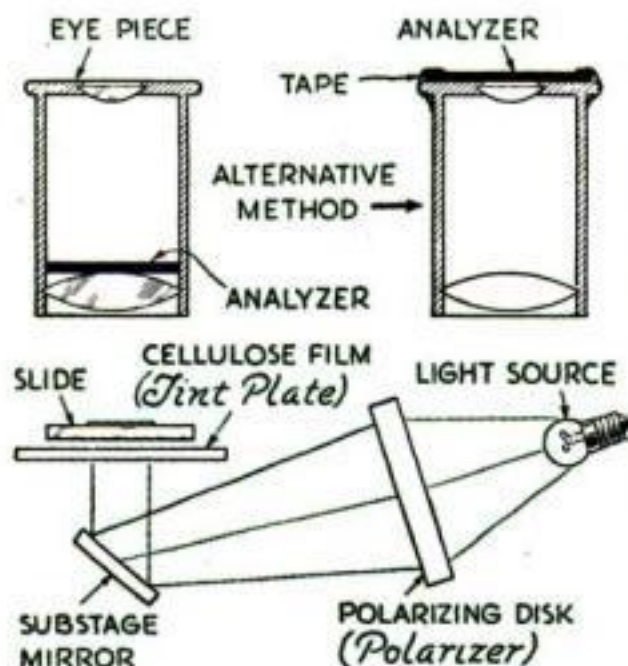
For example, you probably have, as a yuletide by-product, a considerable quantity

of ribbons, strings, strips of cellulose film, and cords used to tie gift boxes. Select an ordinary cotton string, and with a needle tease out some of the fibers. Put them on a glass slide and focus your microscope on them, at, say, 50 to 100 diameters. You will see the characteristic flattened, twisted fibers of cotton. Now take a piece of ribbon, tease some of the fibers from it, and look at them. You may find more of the curly cotton fibers; but you also will, if it is a "silk" ribbon, discover either fibers of genuine silk or of rayon. Genuine silk strands are fairly smooth of surface, and consist of two fibers cemented together. Fibers of artificial silk are uniform in diameter, and often have surfaces marked with numerous fine, parallel lines running lengthwise. It is interesting to make permanent mounts of such fibers, for later reference. Simply place a few short lengths on a glass slide, add a

By MORTON C. WALLING

Cellulose film, now a popular wrapping material, is useful to the microscopist

The drawing below shows how cellulose film is used as a tint plate to color objects for observation



Placed under the slide, the cellulose is moved through various angles. The microscope is equipped for polarized light

drop of balsam, and then a cover glass. Be sure the fibers are perfectly dry. Also, you may find it advantageous to moisten them with xylol before adding the balsam, to help chase out the air.

You wonder what the fibers would look like in cross section? It is a simple trick to make a plate for holding short lengths of fibers so you can examine their ends. Obtain a flat piece of brass measuring 1" by 3", and about the thickness of eight or ten of these pages; and with a fine-toothed hack saw, or better still a jeweler's saw, make one or more slits extending in for $\frac{1}{2}$ " from one edge. Remove the burr with an abrasive stone. Take a bundle of the fibers you wish to examine, and wedge them tightly in one of the slots. Then, with a sharp razor blade, shave off the projecting portions flush with the surface of the plate. The short sections left in the slot will transmit enough light to make their structures visible. You can, if the fibers have a tendency to loosen, use flexible liquid collodion, which you can get at a drug store, to cement them in position. In addition to cutting one or two slots in the plate, drill several small holes of different sizes in a row near the center. A use for these holes will be described a little later.

For making permanent mounts of fiber cross sections, shave off both ends of the bundle in the slot as described; then with your finger nail or the end of a pencil eraser, push the fibers a little way out of the slot, so they project above one surface of the plate. Spread a layer of collodion over them, let it dry, and with a sharp razor shave off both the fibers and the collodion. Transfer the section to a clean slide, moisten it with xylol, and mount in balsam.

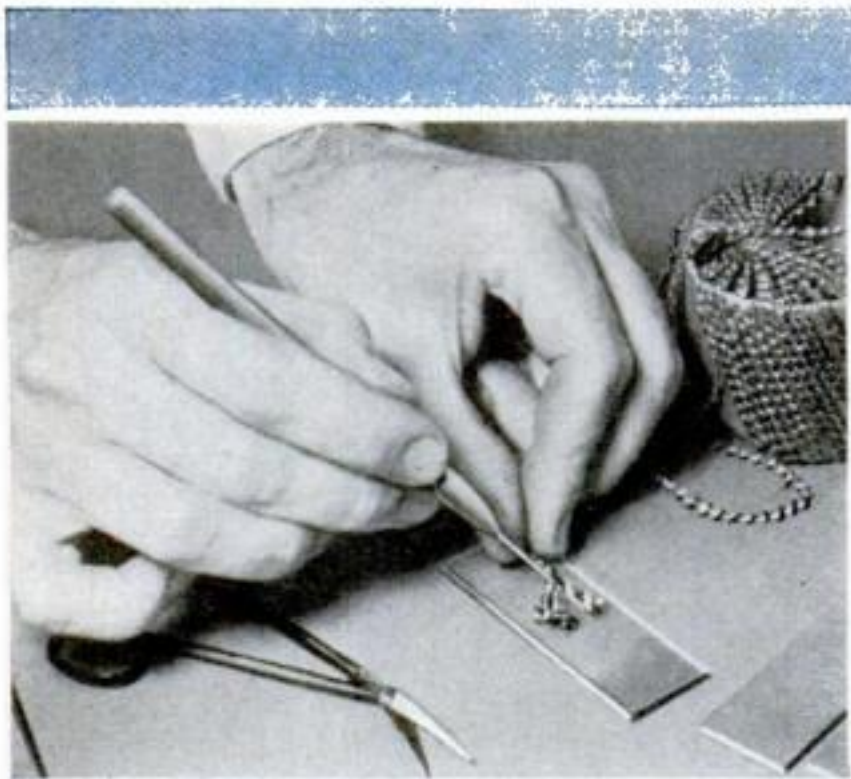
Those cellulose Christmas ribbons or package wrappings will provide startling beauty if you possess a pair of polarizing disks for your microscope (P. S. M., Dec. '39, p. 206). Simply crumple some bits of



A twig from the Christmas tree will provide a surprising amount of material for microscopic study. Here the leaves or needles are being snipped off

the cellulose, place them on a slide, and examine them by polarized light. Beautiful colors will be visible. One or more thicknesses of cellulose placed beneath other polarizing objects will alter their colors.

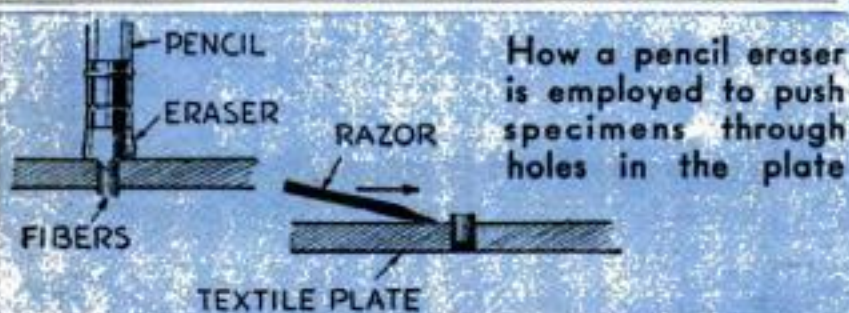
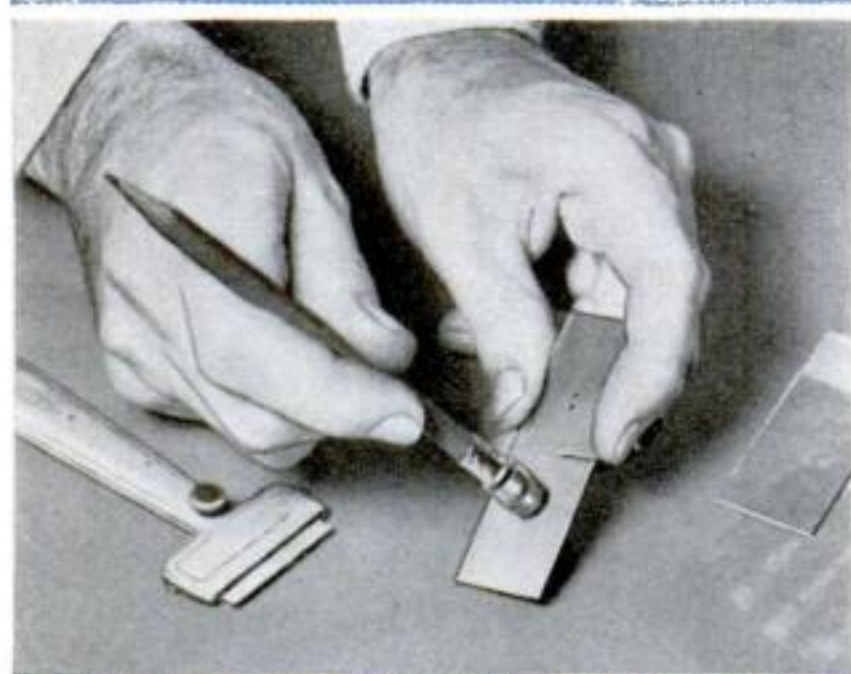
Christmas candy sometimes is adulterated by the addition of cornstarch or other starchy materials. It is an easy matter for the owner of a microscope capable of forming clear images at 300 to 500 diameters to test for such starch. Polarizing equipment is necessary. Simply dissolve some of the suspected candy in water, place a drop of the solution on a slide, add a cover glass, and examine in polarized light,



Teasing wrapping cord to separate the fibers so that they can be mounted on a slide. Silk, cotton, and rayon fibers are easily recognized



Cutting cross sections of textile fibers in a metal plate provided with slots and holes. A sharp safety-razor blade is used for the cutting



Starch grains from candy by polarized light



Cotton fibers from twine that bound a Christmas package

with the polarizer and analyzer crossed or nearly so. Use 250 diameters or more. The starch grains will reveal themselves by characteristic dark crosses formed by the action of polarized light. Different kinds of starch appear of different size and have somewhat different patterns. You can identify that found in candy or other food by comparing the grains with starch of known identity, such as that from arrowroot, corn, or wheat. Irish potatoes produce a starch having particularly large, and therefore easily observed, grains.

Perhaps the most extensive source of microscope material at Christmas is the Christmas tree. This is invariably a member of the evergreen family that scientists call gymnosperms because they have "naked seeds." There are many things about the gymnosperms that make interesting subjects for study with a compound microscope.

First, the leaves or needles. They are, as you already know, long and slender and green; and you may have noticed that they usually point in such a way that the sunlight, when the tree is growing under normal conditions, strikes many of them endwise. There is a connection between the shape of the leaf and the way it orients itself with respect to the light. With your microscope, you can learn more about this connection.

With a sharp razor, slice a pine leaf into thin cross sections. One way to do this is to place it inside a split piece of carrot, apple, or cabbage stalk, which serves as a support while you slice both leaf and its holder with a sharp razor. Wet the razor blade, so the thin section will float on the water as soon as it is free. Another way of making sections of pine needles *(Continued on page 237)*

Fun in the Home Laboratory



Luminescence in full color! In each glass, the solution glows weirdly with light of a different color

LET'S put away the laboratory supports, the retorts, and the siphon jugs—and go on a chemical spree. This time we needn't bore stoppers, bend glass tubing, set up a train of chemical apparatus, and tend Bunsen burners. For here is a series of experiments—with a spectacular display of self-luminous solutions for a grand finale—that needs no more equipment than a beaker or so, a medicine dropper, and a few test tubes, glasses, and bottles.

In one of Jules Verne's famous scientific romances, travelers in another world come upon a lake of mirrorlike calmness, unfrozen although the temperature is well below freezing. One of the voyagers tosses in a pebble. Instantaneously, with a great sigh and quiver, the whole lake freezes! Old hands at amateur chemistry recall a real parallel of this bit of fantasy.

The familiar form of the experiment consists of heating half a handful or so of sodium thiosulphate crystals in a beaker or flask, with no addition of water. The crystals melt, dissolving in

their own water of crystallization—the water together with which the crystals were “frozen” in their solid state. If the heavy liquid is left undisturbed, and the crystals from which the solution was made were free from the slightest contamination from a paper bag or other container, the solution will cool without resolidifying. But insert another sodium thiosulphate crystal or any foreign matter such as a piece of wood, in this supersaturated solution, and it will instantly “freeze” or crystallize.

You can duplicate this experiment on a miniature scale. Place a crystal or two of sodium thiosulphate on a microscope slide or strip of glass. Heat it gently from the bottom with a very low flame. The crystal will melt. When the resulting liquid has cooled a little, it will instantly recrystallize from a molten state if it is shaken, or touched with the sharpened end of a match stick. Sodium acetate also works nicely in this experiment, when treated in the same way, as do aspirin, acetanilid, and in fact

By
RAYMOND B.
WAILES



Jules Verne's yarn, about the lake that froze suddenly when a pebble was thrown into it, is paralleled in a striking experiment, in which a melted crystal recrystallizes at once at the touch of a match stick

practically any of your organic chemicals that melt without decomposition.

By inducing "rhythmic" crystallization of various chemicals, you can produce a curious pattern like Saturn and its rings upon a sheet of glass or filter paper. Make a very strong solution, in water, of cupric chloride or of nickel sulphate. Place a little pool of the liquid, about a centimeter in diameter (or roughly the size of the nail of your little finger), upon a sheet of glass in a warm room. In several hours, the liquid will have evaporated. You will then observe the odd fact that concentric circles of crystals are left, with no crystals in between. The same property is shown by alcohol solutions of such organic chemicals as thymol, cinnamic acid, and acetanilid.



Though it takes considerably longer, a similar effect may be strikingly shown by letting one or two drops of copper sulphate solution fall in the center of a sheet of filter paper, supported by the mouth of a beaker or tumbler. Wait several hours until the copper sulphate has dried, and then let one or two more drops of the solution fall at the same spot. Next day, add another drop or two, and repeat this for several days or weeks. Spreading, the solution will form blue rings of copper sulphate, up to about two inches in diameter, between which the paper remains white.

A curious test-tube stunt might be called the "traveling precipitate" experiment. To perform it, you will need some barium sulphate. Making this chemical for yourself is easy, if you have a solution of any other barium chemical, such as barium chloride. Add sulphuric acid or a solution of a sulphate, such as sodium sulphate. A heavy, white precipitate of barium sulphate will form. Make enough of this precipitate so that you will have about a teaspoonful of it. Filter it off from the liquid and wash it well, while it is still on the filter paper, by pour-



By dissolving aluminum nitrate in methyl alcohol and adding aniline, you can grow odd "chemical whiskers"

ing several portions of hot water through the filter.

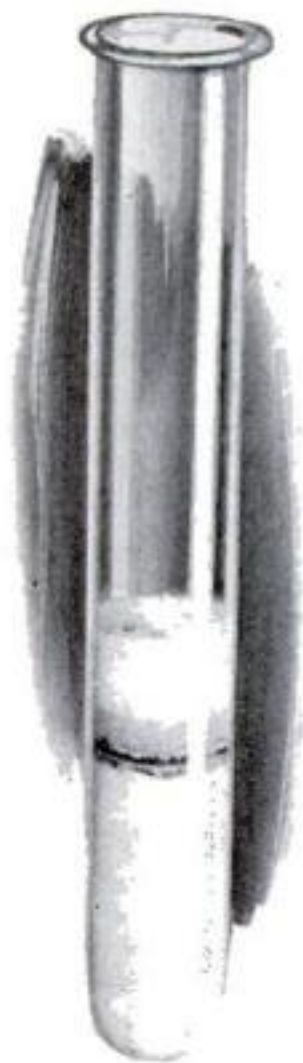
Now, using a spatula, half fill a small test tube with the barium sulphate precipitate. Add a solution of mercuric chloride (**CAUTION: deadly poison if swallowed**), and shake the tube well to let the solution come in contact with the precipitate. Then let the tube stand overnight, while its contents settle.

Next day, with a medicine dropper or by other safe means, remove the clear solution of mercuric chloride that overlies the precipitate of barium sulphate. Then add to the tube about ten drops of a solution of potassium iodide. It reacts with the mercuric chloride that impregnates the barium sulphate precipitate, and the result is a bright scarlet precipitate of mercuric iodide. During the next few hours, you will see this scarlet ring traveling downward through the white mass in the tube. Ultimately it comes to rest with white barium sulphate above and below it, at a point depending upon the strength of the potassium iodide solution used.

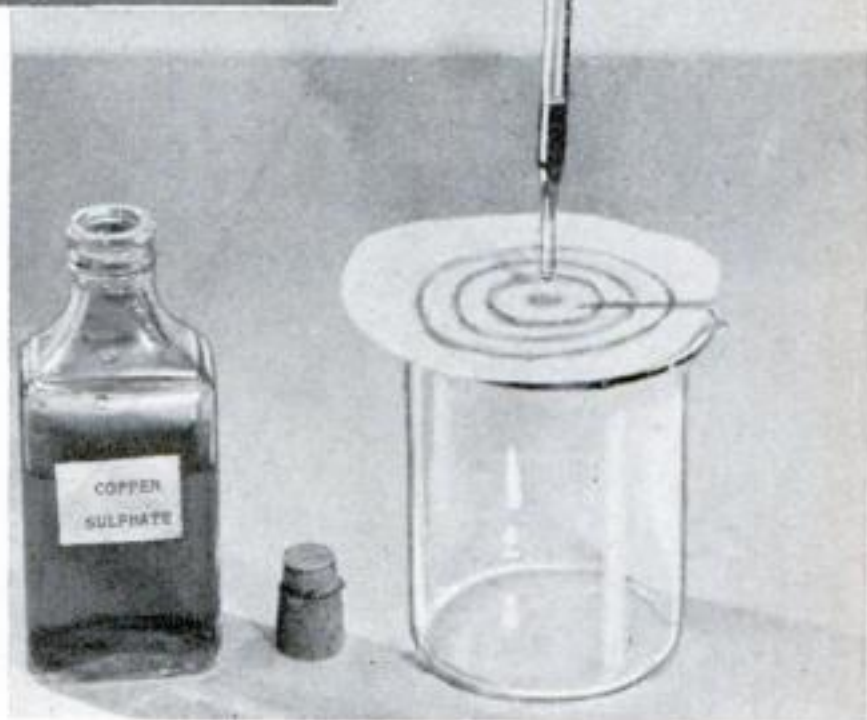
While you are growing crystals, and making precipitates travel without leaving a trail behind them, you might be interested in growing some "chemical whiskers." Dissolve crystals of aluminum nitrate in methyl alcohol (wood alcohol or methanol) until the solvent is practically saturated with the chemical. Mix this solution with an equal volume of aniline. A coagulated product called a gel will be formed. Pour off the

excess liquid into a watch glass, and set it aside for several days while it evaporates spontaneously. White, hair-like crystals of aniline nitrate, often an inch or more long, will form. The gel residue, if allowed to dry out, will also sprout small crops of hairlike crystals.

How rapidly a chemical crystallizes may be greatly influenced by adding small amounts of other substances. Make a rather strong solution of lead nitrate in water, and divide it into two portions. Color one of these by adding a bit of methylene blue, a dye used in microscopy. Pour little pools of the colored and uncolored solutions on a glass



The "traveling precipitate." Mercuric iodide comes to rest at one level in the test tube



The result of this experiment in "rhythmic" crystallization resembles a picture of the planet Saturn with its many concentric rings

plate, and let them evaporate. The solution colored with methylene blue will crystallize first, and the blue-tinged cubical crystals of lead nitrate will be larger than the crystals from the uncolored solution.

Now for the promised experiment with self-luminous solutions. Readers of this series will recall the magical blue glow of a luminol solution in the dark (P. S. M., Oct. '37, p. 80). Quite recently, several chemists have discovered how to impart a whole variety of hues to the glow of luminol. The resulting color effects, which you can readily reproduce, are even more showy. Several different shades of orange are obtainable, the blue can be tinged with green, and a shade of gold can be produced in which the swirling chemicals give the most beautiful display of all.

Luminol, the chemical used in these experiments, is itself a product of comparatively recent research. Its name (which should not be confused with that of luminal, a drug-store preparation for insomnia) is short for what chemists know as "3-aminophthalhydrazide." The ordinary drug store will not be able to furnish you with luminol, but you can obtain it from a well-stocked dealer in chemicals and laboratory supplies.

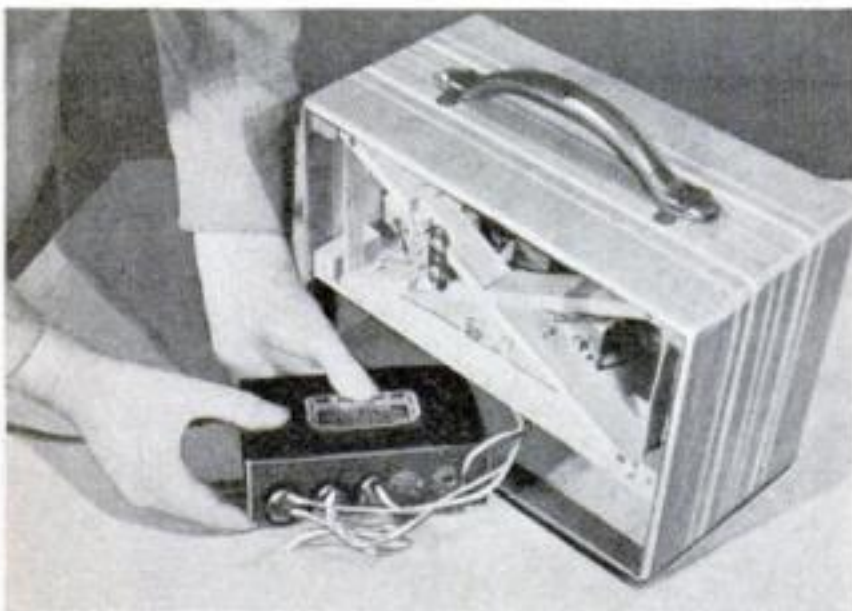
Two solutions (*Continued on page 235*)

SEVEN NEW IDEAS



Radio and Bed Lamp in One

COMBINING a five-tube receiver and a glareless reading light, the outfit shown in use above attaches readily to the head of a bed. Operating on house current the set has its controls at the bottom for convenience.

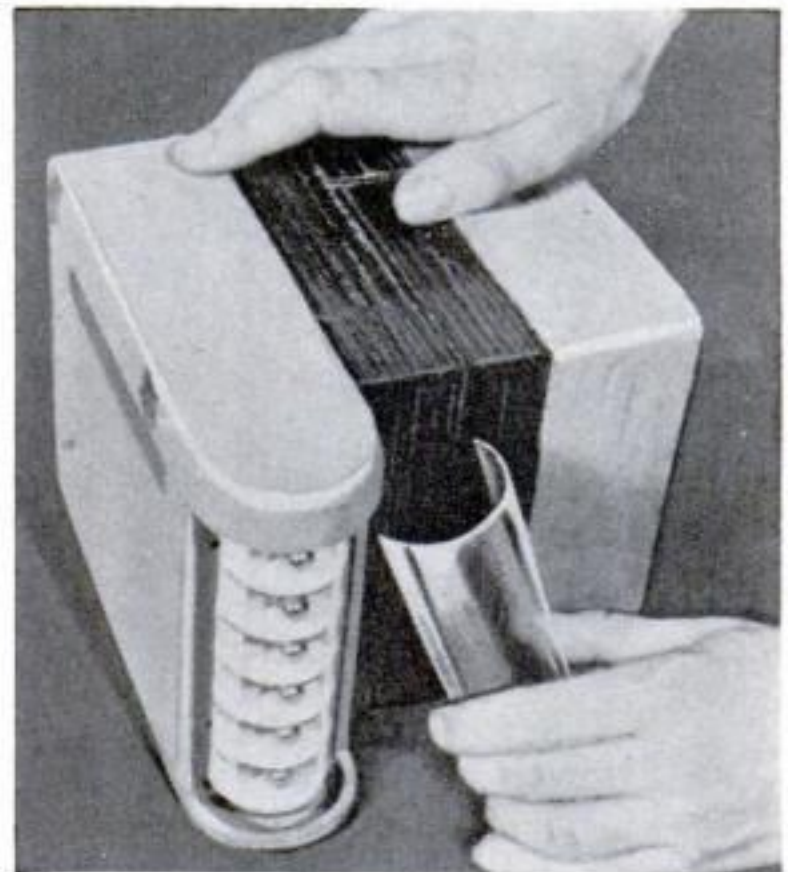


Handy Battery Eliminator

SMALL enough to fit inside conventional portable radios, a new power unit is designed to convert battery-operated portables into electric receivers for indoor use. Operating on either alternating or direct current, the device will power any receiver using $1\frac{1}{2}$ -volt tubes, quickly converting it and eliminating both "A" and "B" batteries.

Transformer Terminals Get Safety Shield

OF NOVEL design, a new streamline audio transformer has all its terminals protected by a flexible transparent-plastic cover that safeguards radio experimenters against accidental shocks and protects a radio circuit against short-circuits. It is shown below.



Adjustable Clamp Stand Holds Soldering Iron

A CLAMP STAND just introduced for holding any type of soldering iron at any desired angle provides an effective "third hand" for facilitating the work of radio fans. A thumbscrew holds the supporting bracket at a convenient height while the bracket's adjustable jaws grasp the iron.



With the stand holding the iron, both hands are free

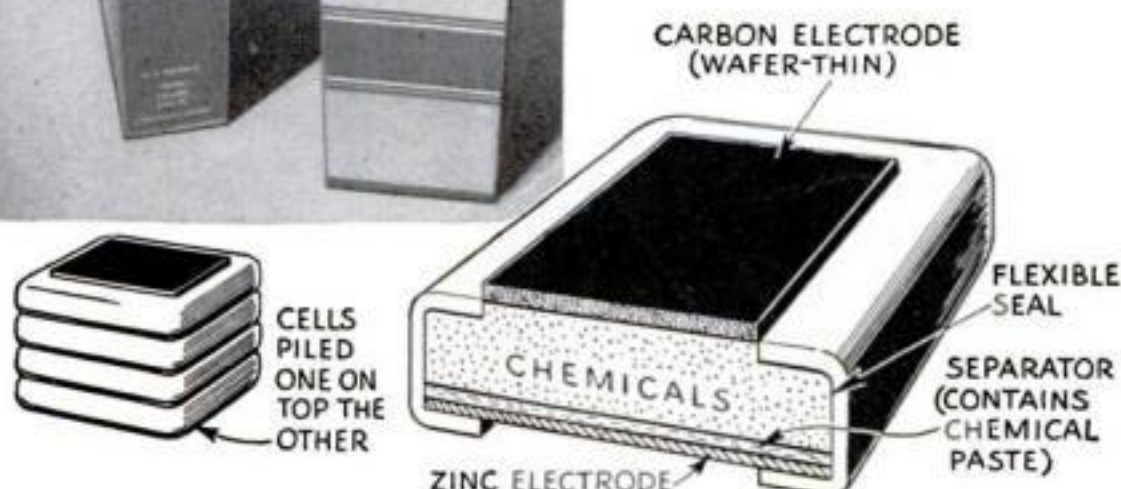
FOR RADIO AMATEURS



New "B" Supply of Small Size Designed for Portable Sets

Comparative size of the new and old "B" batteries may be seen at the left. Below, one of the compact cells that allow size to be reduced

ALMOST halving the size of conventional "B" batteries for small, portable receivers, the new-type battery shown in the illustration at the left has the same capacity as older types, weighs only two pounds, and measures but $1\frac{3}{4}$ " by $3\frac{1}{2}$ " by $5\frac{3}{8}$ ". The battery incorporates a special type of flat cell that eliminates waste space, and a special expanding composition seal in place of the usual air space to take up room as the gases escape from the cell chemicals during the time it is supplying current.

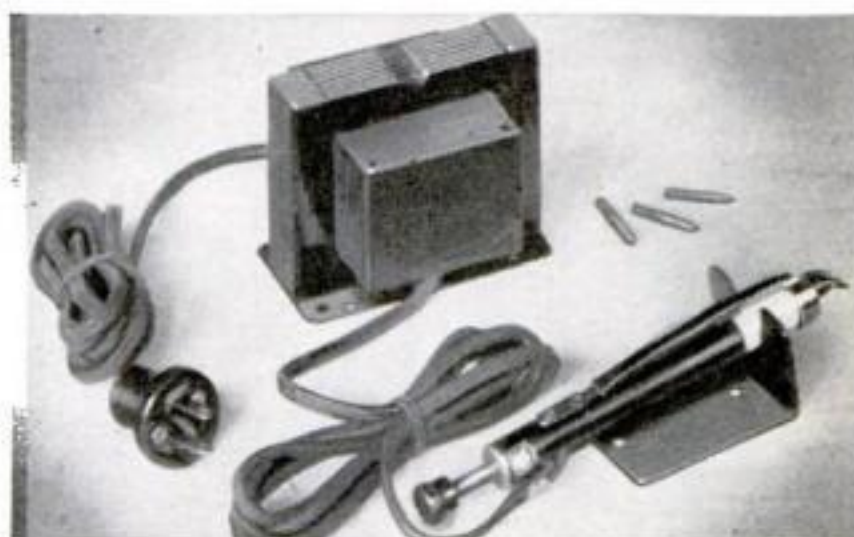


Map of World Is Antenna

WITH a map of the world on its surface, an indoor antenna that may be used with any radio receiver modernizes the appearance of a set and dispenses with unsightly room aerials. It may be placed in its special stand or hung on the wall like a picture.



This decorative antenna eliminates unsightly wires



Tiny Electric Arc Heats Radio Soldering Tool

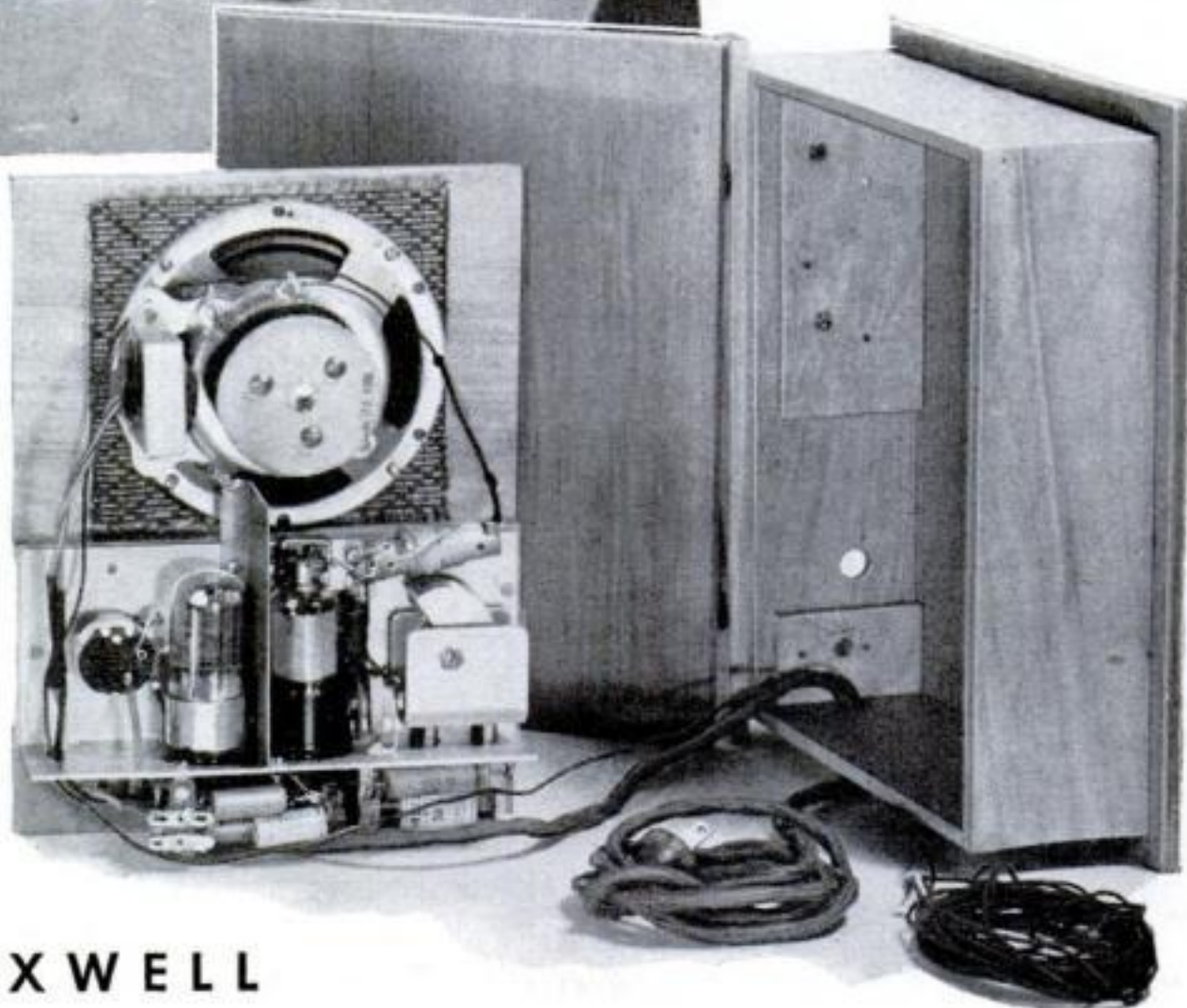
SIMPLY plugged into an outlet, an ingenious soldering iron for radio builders is brought to working temperature by an electric arc in less than ten seconds. Little larger than a fountain pen, the iron has a handy power switch conveniently located on the handle. The arc is drawn between the iron's tip and a renewable carbon electrode that projects from the center of the soldering tool. A thumbscrew permits adjustment of the gap to produce an arc of maximum efficiency for heating the working tip. According to the manufacturer, the iron is particularly useful for radio work since its small size and design permit it to be held like a pencil so that delicate soldering operations are greatly simplified. Power is supplied by a transformer designed for use on 110-volt alternating current.

Library-Table Radio



Putting the finishing touches on the chassis of the extremely compact "scrapbook" radio

Notice the shield separating the two tubes, with its soldered connection to the metal frame of the permanent-magnet speaker



MAKING an attractive decoration for the library table, this book radio will appeal to all builders who prefer housing their receivers in some unusual type of cabinet. It can be easily assembled and built at home by any beginner, and the entire set, including the cabinet, should cost less than ten dollars.

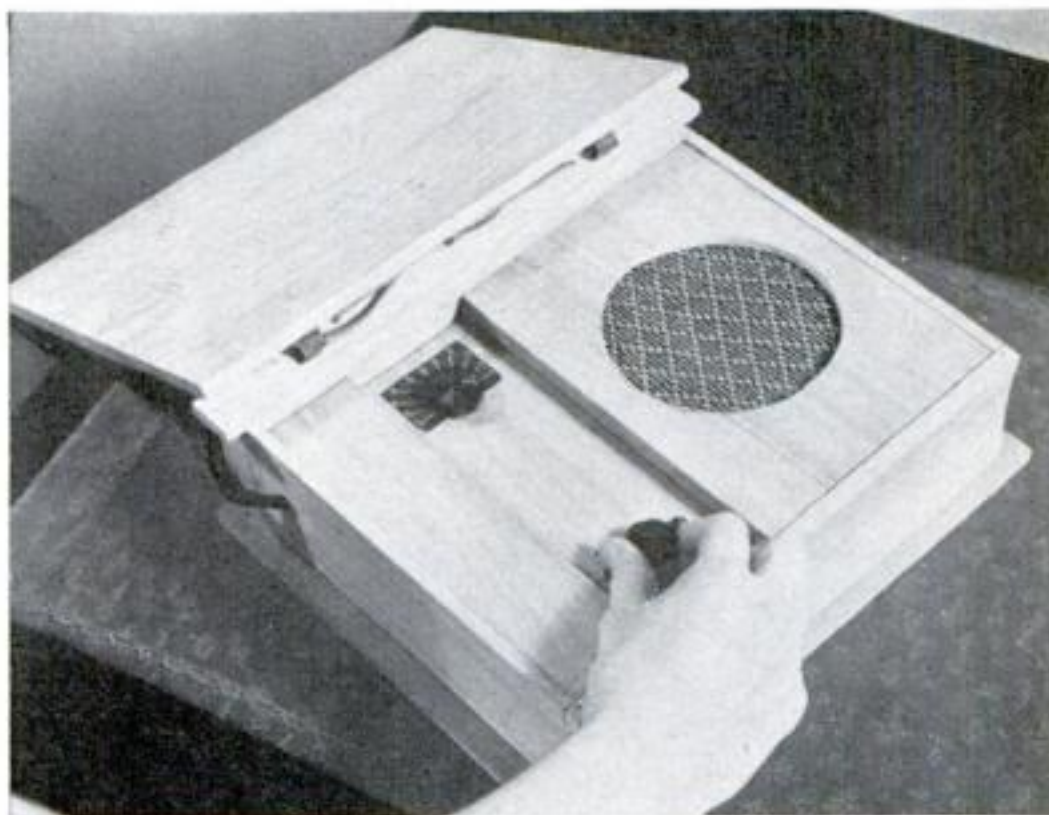
The cabinet for the receiver was made from the wooden covers removed from a large scrapbook which cost less than a dollar at a local department store. The covers serve as the bottom and hinged top of the cabinet, while the sides were built up, as shown in the drawings, from matching wood. A jigsawed decoration on the cover, left intact, adds to the attractiveness of the cabinet.

By
CLARK MAXWELL

Resembles a Book

The circuit, which appears to use only two tubes, has in reality plenty of punch behind it, since the two tubes do the work of four. The first tube (12B8GT) contains a high-frequency pentode and a high-mu triode. The high-frequency pentode is used as a regenerative detector which is resistance-coupled to the triode. The triode is in turn resistance-coupled to a pentode element in the second tube. This second tube (25A7GT) contains, besides the output pentode, a half-wave rectifier. A 260-ohm line cord reduces the house current to the voltage required by the heaters of the two tubes.

For the sake of compactness, a small A.C.-D.C. antenna coil is used. As the coil has no tickler winding, the reader will have to add one himself. This can be done easily by winding approximately thirty-five turns of double-silk-covered wire around the bottom portion of the grid coil. If tests show too little volume, re-



The booklike radio in use, showing its recessed control knobs

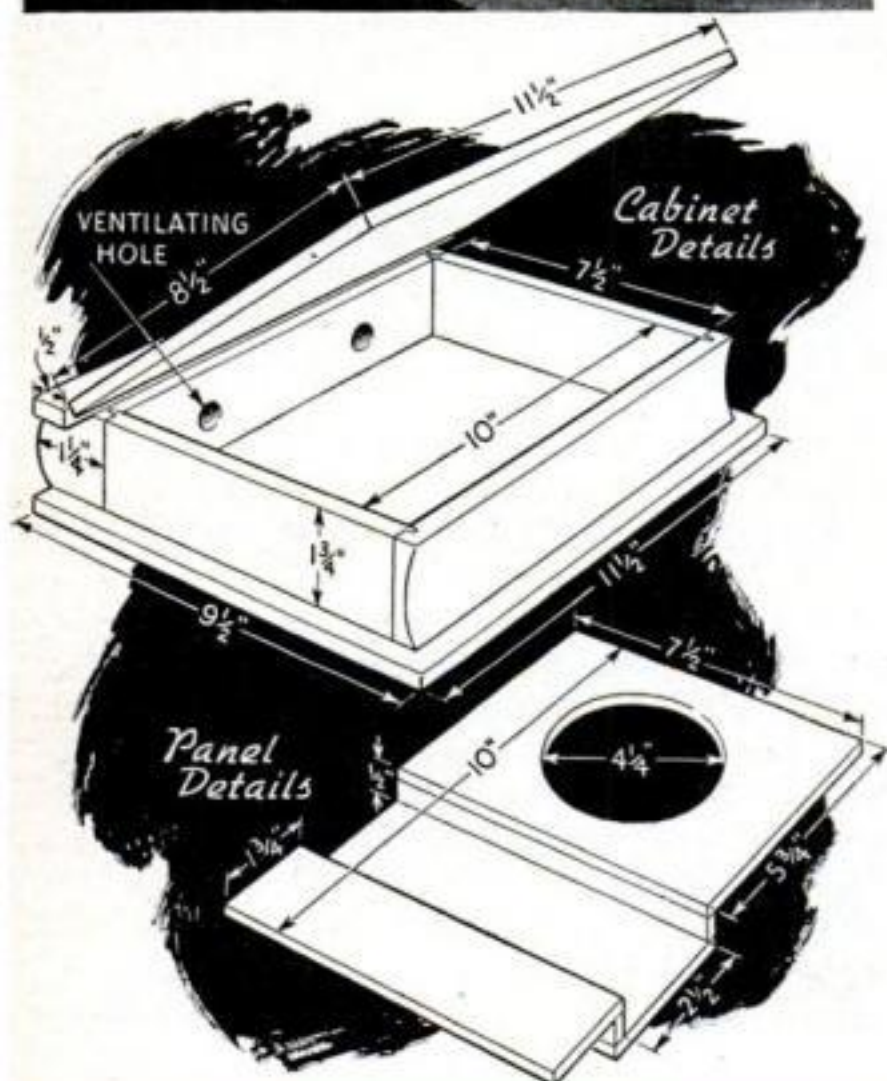
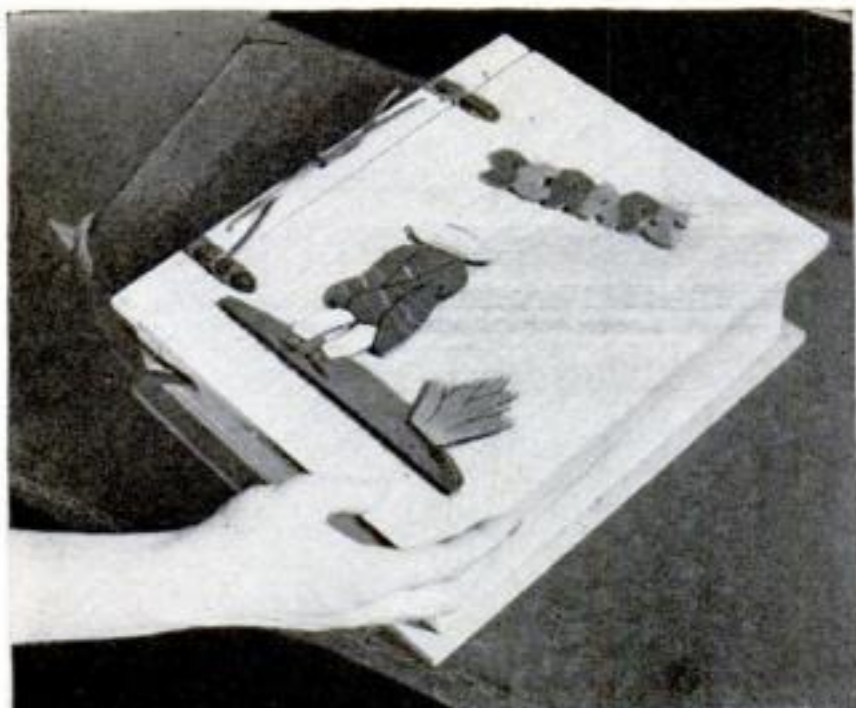
verse the connections to this tickler winding.

A five-inch permanent-magnet speaker is used, with its cone facing upwards. Choose a speaker whose depth does not exceed $2\frac{3}{8}$ ", otherwise the cabinet will have to be made deeper.

The reader will notice that a shield is used between the two tubes. This is necessary as the feed-back coupling between these tubes would cause a terrific hum. Arrange the shield so that its top portion almost touches the frame of the speaker and make a soldered



When the cover is shut, the set makes an ornamental piece to put on the library-table top



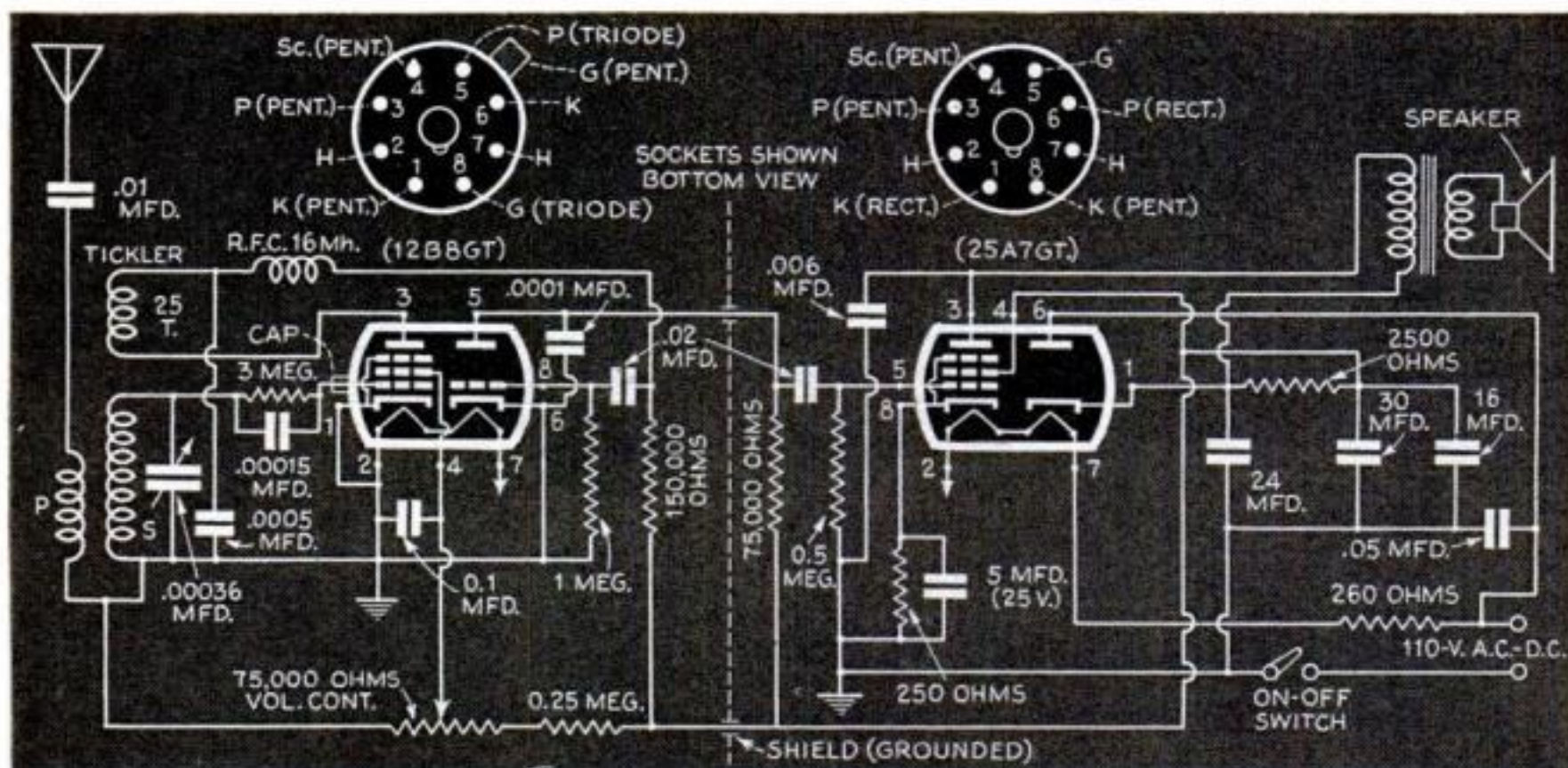
LIST OF PARTS

Midget antenna coil.
 Radio-frequency choke, 16 mh.
 Potentiometer (75,000 ohm) and switch.
 Line cord, 260 ohm.
 Triode-pentode tube (12B8GT).
 Rectifier-pentode tube (25A7GT).
 Permanent-magnet speaker
 (5" diameter).
 Tubular paper condenser, .1 mfd.
 Tubular paper condenser, .05 mfd.
 Tubular paper condensers (two).02 mfd.
 Tubular paper condenser, .01 mfd.
 Tubular paper condenser, .006 mfd.
 Mica condenser, .0005 mfd.
 Mica condenser, .00015 mfd.
 Mica condenser, .0001 mfd.
 Midget tuning condenser.
 Electrolytic condenser, 5 mfd., 25 volt.
 Electrolytic condenser, 16 mfd., 150 volt.
 Electrolytic condenser, 24 mfd., 150 volt.
 Electrolytic condenser, 30 mfd., 150 volt.
 Resistor, 500,000 ohm, 1/2 watt.
 Resistor, 250,000 ohm, 1/2 watt.
 Resistor, 150,000 ohm, 1/2 watt.
 Resistor, 75,000 ohm, 1/2 watt.
 Resistor, 1 meg., 1/2 watt.
 Resistor, 3 meg., 1/2 watt.
 Resistor, 2,500 ohm, 1 watt.
 Resistor, 250 ohm, 1 watt.

Miscellaneous: Two octal sockets;
 aluminum chassis, 1 3/4" by 3" by 7 3/8";
 special cabinet; knobs; dials, etc.

connection between the shield and the frame.

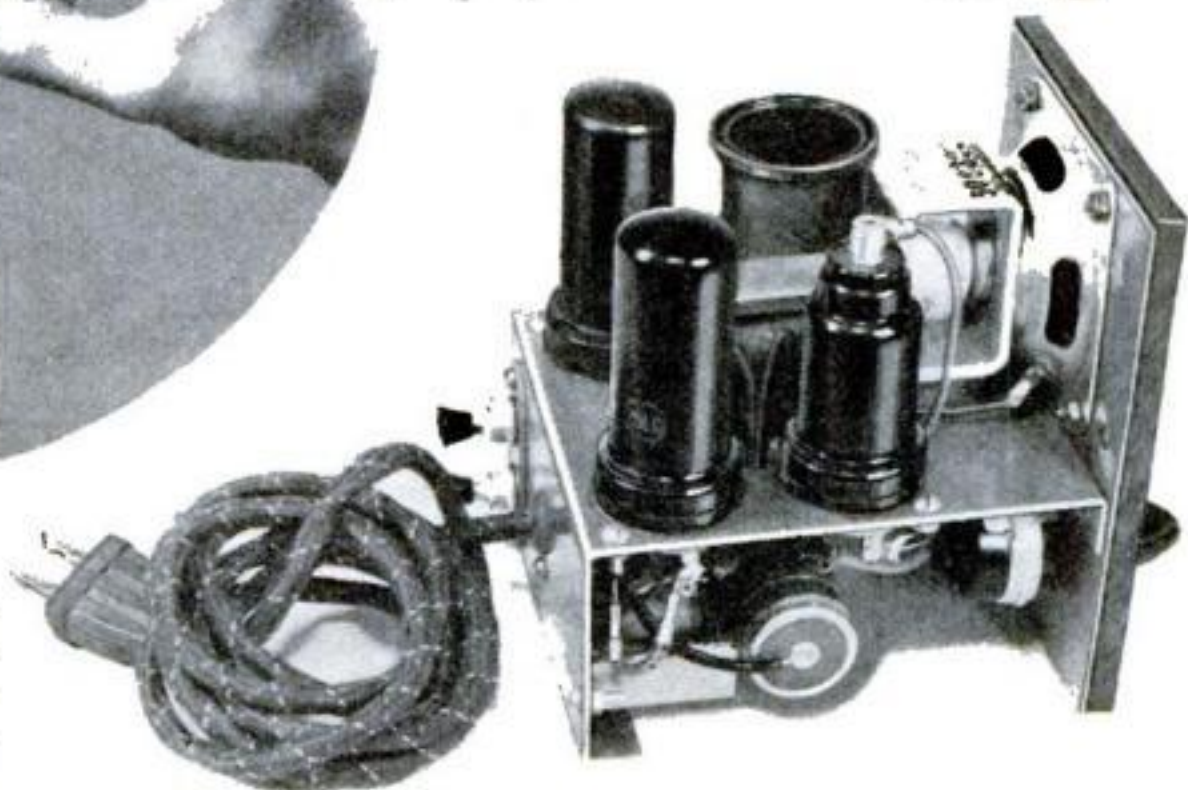
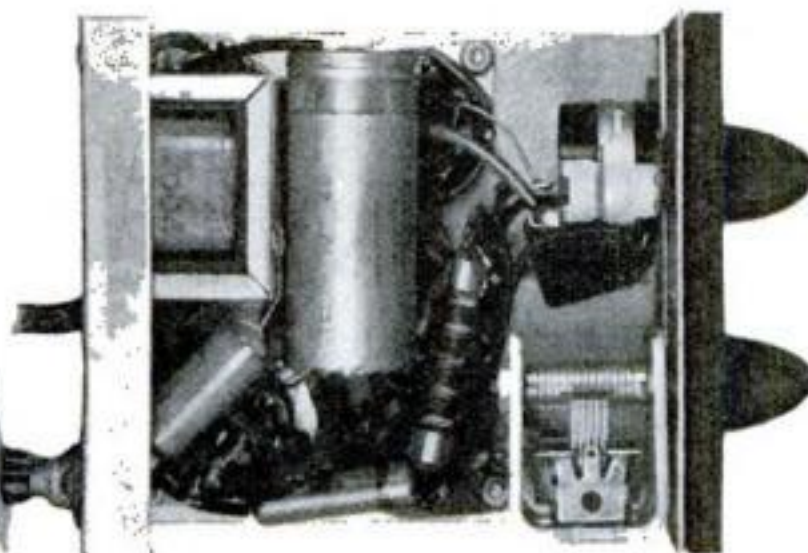
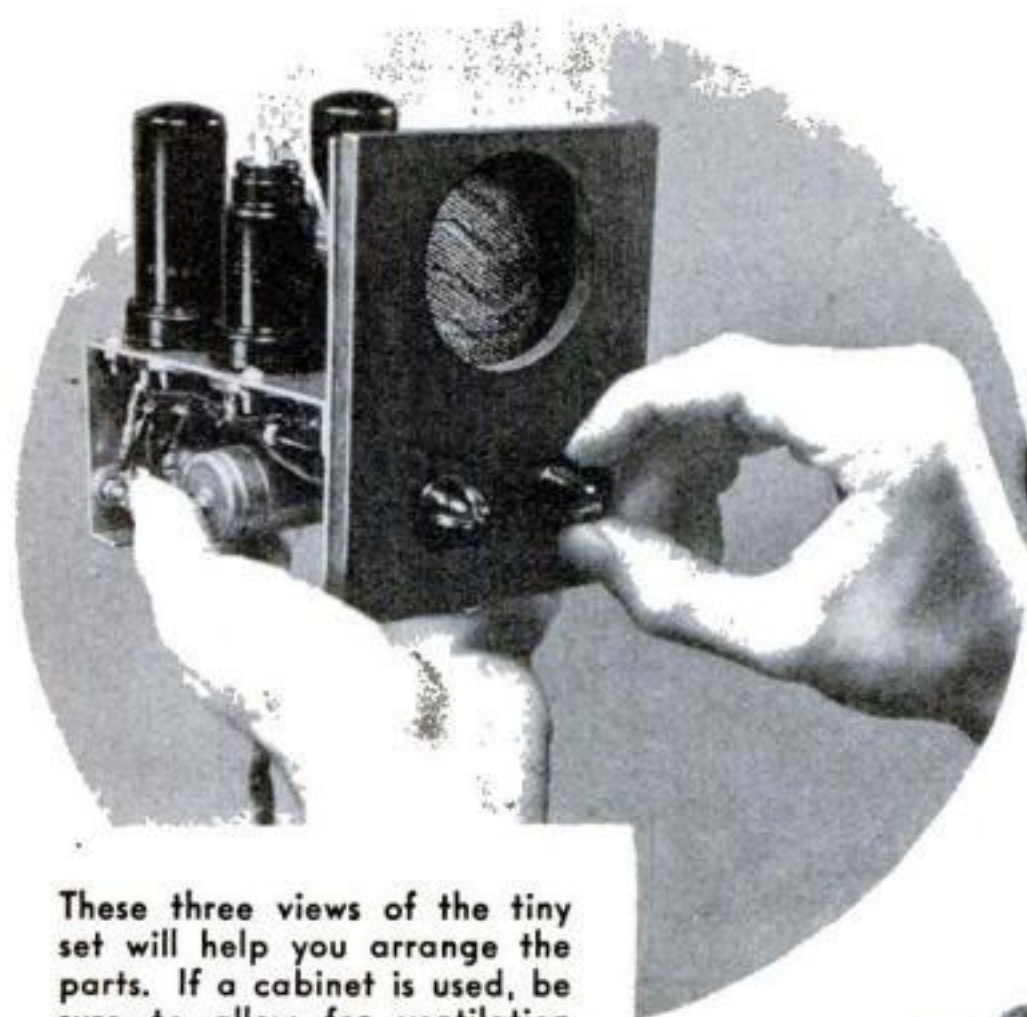
Regeneration is controlled by varying the screen voltage on the detector with the 75,000-ohm potentiometer, one side of which is connected to the plus "B" voltage through a 250,000-ohm, half-watt resistor, the other side grounded to the chassis.



Top, the cut-out cover decoration. Diagrams—cabinet, panel, and wiring—give all construction details

Tom Thumb Radio

FOR THE NEW
MIDGET SPEAKER

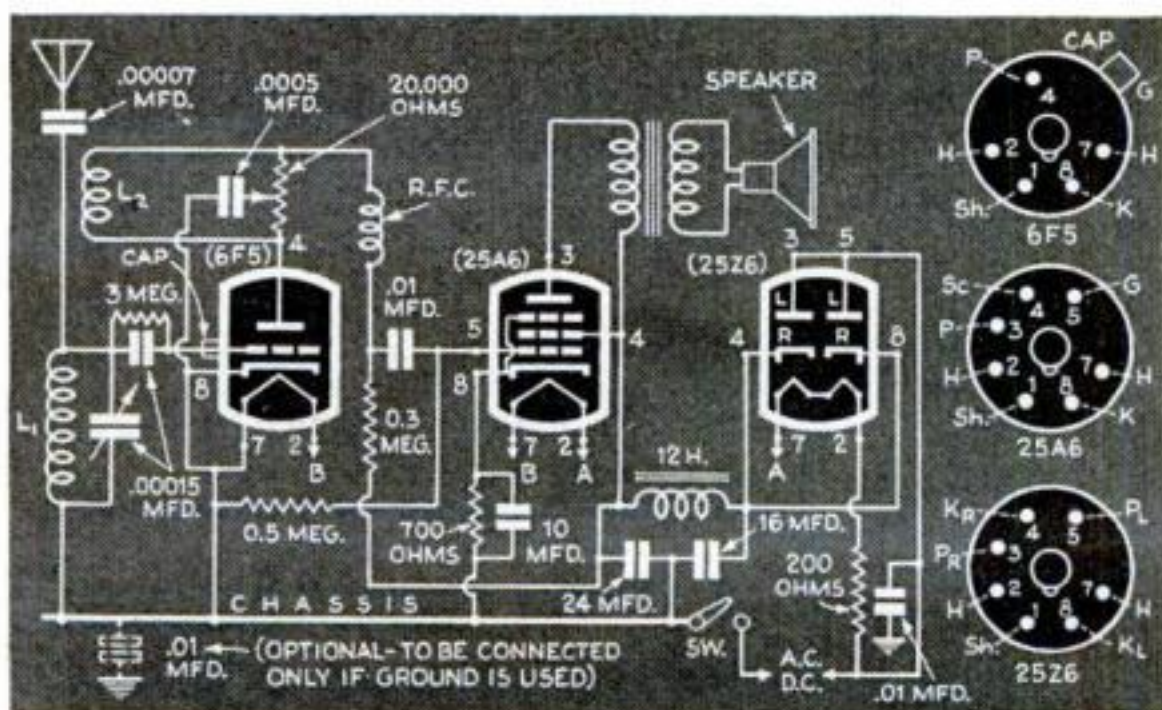
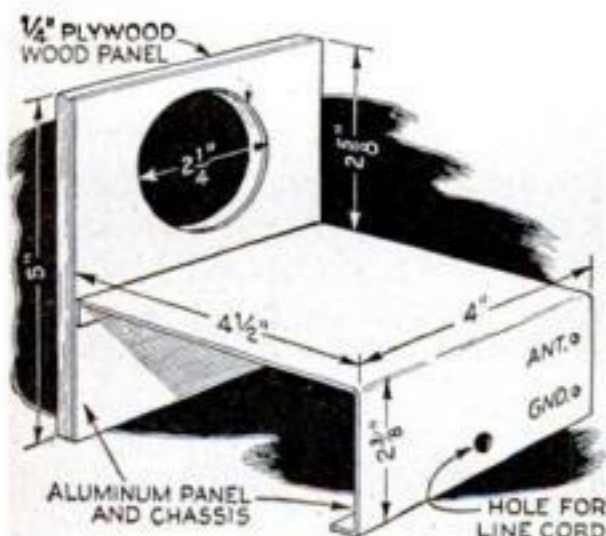


These three views of the tiny set will help you arrange the parts. If a cabinet is used, be sure to allow for ventilation

USING a new cone-type permanent-magnet speaker only 2" in diameter, this radio midget among midgets is inexpensive, easy to build, sensitive, and powerful despite its size. The broadcast-band set uses a four-prong coil consisting of a grid winding and a tickler winding (L_1 and L_2). Regeneration is obtained by a variable resistor across the tickler winding and grounded to the chassis through the .0005-mfd. fixed mica condenser. The 25-mh. choke in the plate lead of the detector (6F5) smooths re-

generation and keeps stray radio-frequency currents from the resistance-coupled audio stage. Another new item in the set is the compact 24-16-10 mfd. tubular electrolytic condenser. A 200-ohm line-cord resistor reduces the house current for the three metal tubes. A $\frac{1}{4}$ " wooden panel in front of the aluminum panel acts as a speaker baffle.

Note dimensions below for the aluminum chassis and panel. The wiring diagram gives all resistance and other values



Handy Helps for Motorists

Studs Help Heavy Trucks Get Across Soft Ground

DRIVERS of trucks with dual-type rear wheels will do well to provide themselves with two lengths of round or square timber for emergency use when the going gets tough on muddy roads or in sand pits where heavy loads must be carried across particularly soft or spongy spots. Placed just in front of each hind wheel, the timbers become effective tracks which the dual tires straddle when the truck moves forward. Four-by-fours are recommended, or poles of about four inches in diameter depending on the weight of the load. Lengths



The tires of each dual wheel straddle the timbers

of eight feet will get you safely across most bad spots, and are not too long for carrying conveniently on heavy trucks without interfering with the load.—W. F. R.

Vacuum-Cup Clothes Hook Holds Pipe on Dashboard

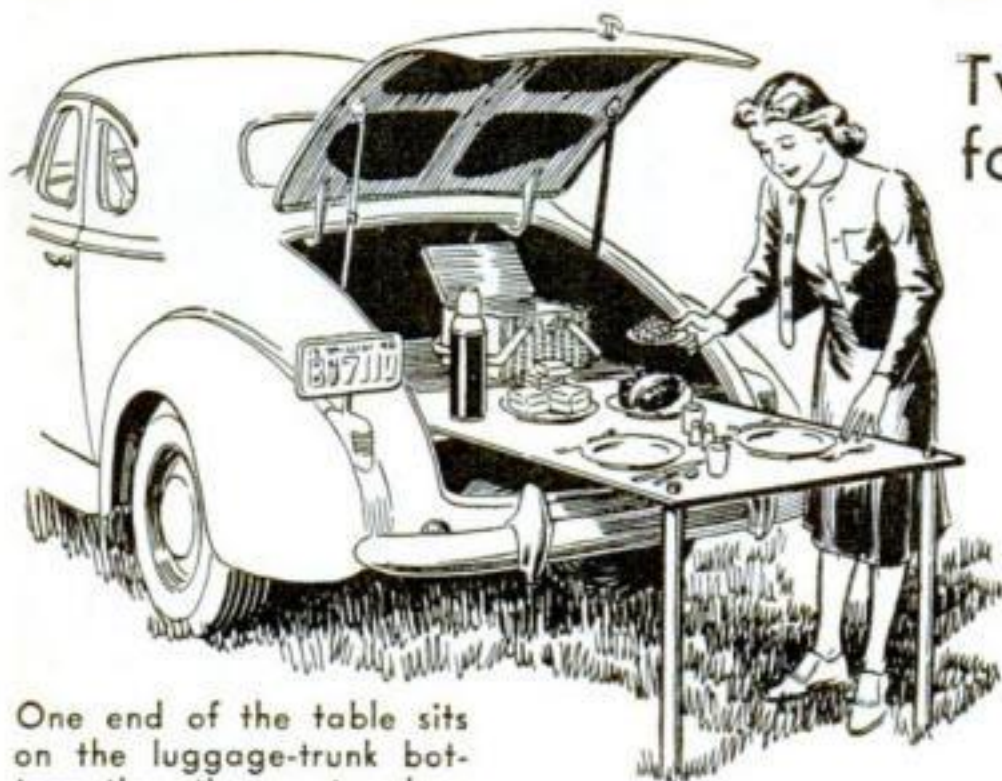
MOTORISTS who smoke pipes will find that an ordinary ten-cent suction-type clothes hanger makes a most convenient pipe holder for the automobile. Fastened to the instrument panel in a handy position, the hook can be bent easily to accommodate any standard-size pipe shank and hold the pipe in an upright position, as in the typical installation shown in the illustration at the right.—J. C. M.



The fixture provides a handy place to put your pipe

Two-Legged Picnic Table for Car's Luggage Trunk

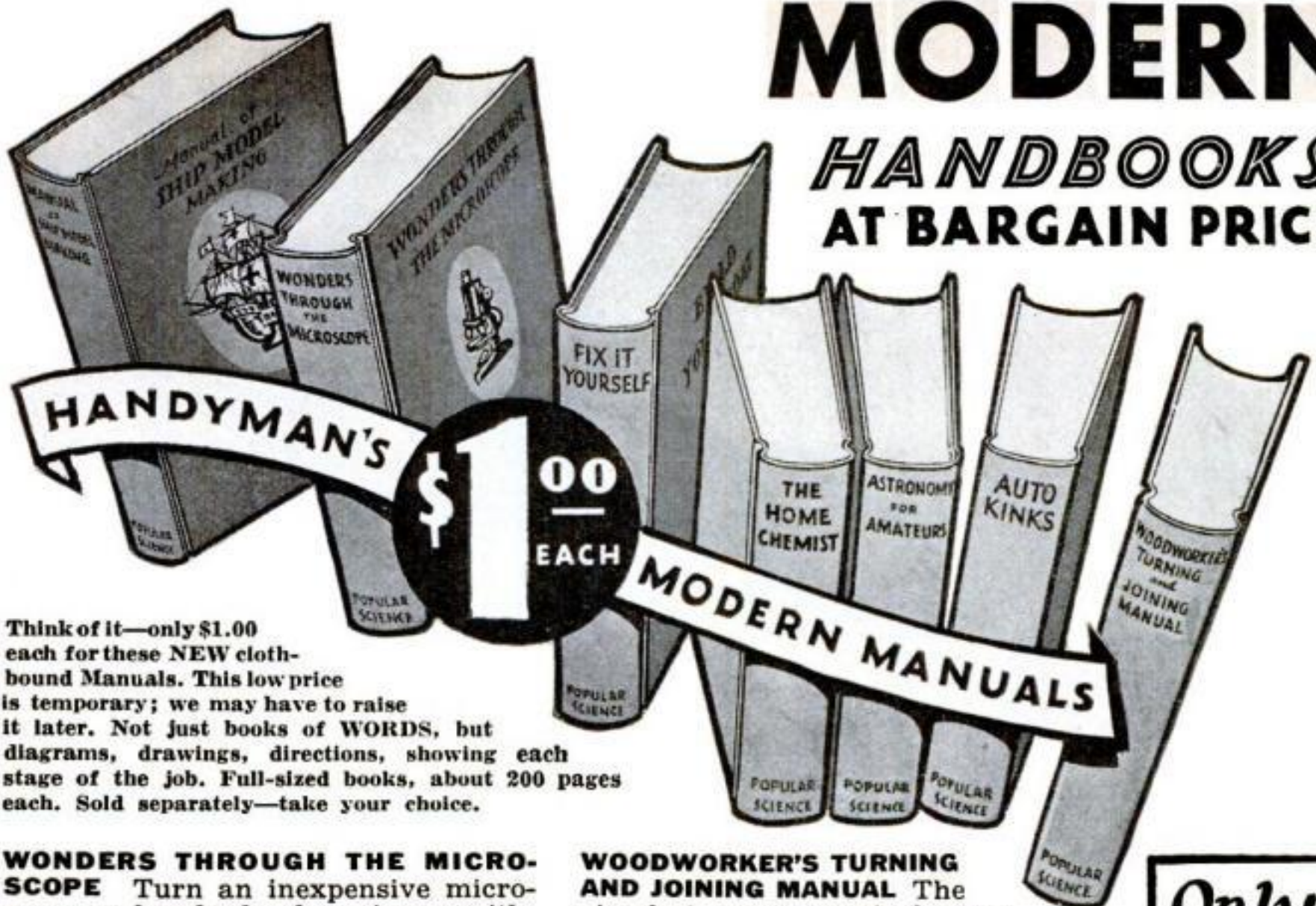
A STURDY picnic table for use at the rear of your car can be made easily from thin plywood as shown in the accompanying sketch. If the floor of your luggage compartment is large, the table can be of one piece. Otherwise, for storing, it can be hinged in the middle to fold like a table-tennis table. Two legs at the back also can be hinged for folding. Their length is determined by the height of the floor of the luggage compartment from the ground.—F. W.



One end of the table sits on the luggage-trunk bottom, the other on two legs

MODERN

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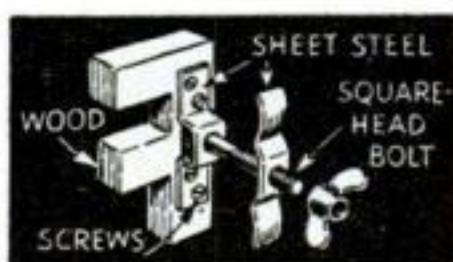
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Car Owner's Initials Decorate Radiator

YOUR initials in block letters two or three inches high and a half inch thick make an attractive decoration for your car's radiator grille. Cut the letters from wood with a jig saw, and mount them by means of wing nuts and bolts attached to the backs of the letters with sheet-metal clamps shaped as shown below. The letters may be painted to match the car's trim.—W. F.



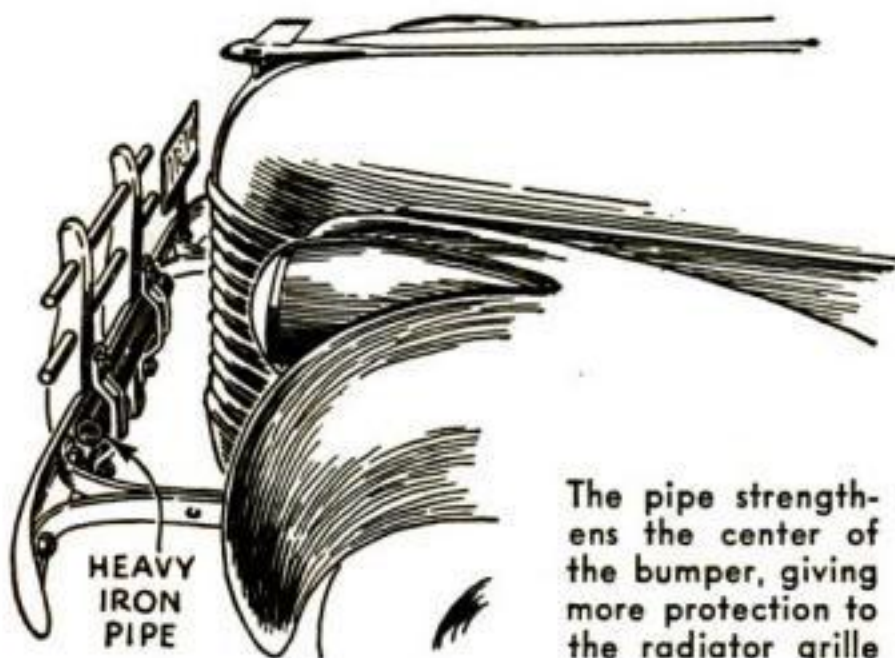
How the radiator-grille initials are made and put on

Windshield-Wiper Tester

I MADE a very useful tester for vacuum-type windshield wipers out of an old tire pump. I took the pump apart and reversed the packing washer on the end of the plunger, then reassembled the unit. Next, I cut off the fitting of the pump hose. To test wipers, it is only necessary to disconnect the vacuum line, insert one end of it into the pump tube, and draw out the pump handle.—R. D.

Heavy Iron Pipe Makes Good Bumper Stiffener

HELD firmly in place behind your car's front bumper with iron straps and bolts, a length of heavy iron pipe provides an effective stiffener to help the bumper withstand blows near its center where it ordinarily is most elastic.—G. P.



The pipe strengthens the center of the bumper, giving more protection to the radiator grille

1 What \$14 camera gives me KODACHROME transparencies?



KODAK BANTAM (f/5.6). No extra equipment; just load with Kodachrome (full-color) Film . . . Through modern photofinishing methods, Bantam (f/5.6) also leads to black-and-white pictures 2 3/4 x 4 inches . . . Kodak Bantam, with Kodak Anastigmat f/5.6 lens, \$14; with Kodak Anastigmat Special f/4.5 lens, \$22.50.

2 What camera recently announced is equipped with that great new

**Supermatic
shutter?**



KODAK MONITOR SIX-20 (f/4.5 Special). The Supermatic is Eastman's new high-precision between-the-lens shutter, that is unsurpassed anywhere in accuracy. 9 speeds to 1/400 second. Other features: Kodak Anastigmat Special f/4.5 lens, new-type body shutter release, double-exposure prevention, automatic film stop. Price, \$42.50.

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PHOTO FAN'S CHRISTMAS-BUYING QUIZ...

3 What great miniature is a sensational value at its present price?



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5 What movie camera is justly known as the "economy movie maker"?



CINÉ-KODAK EIGHT is the "economy home movie maker." Thoroughly capable, it gives 20 to 30 black-and-white movie scenes—each as long as the average newsreel scene—on a roll of film costing \$2, *finished, ready to show*. For color movies, load with Kodachrome Film. Price, \$29.50. At your dealer's... Eastman Kodak Co., Rochester, N. Y.

4 What 35 mm. miniature offers high precision at modest cost?

KODAK 35 ($f/3.5$). Gives you what you must have for dependable black-and-white and Kodachrome (full-color) photography. Precise, long-lasting construction. Special $f/3.5$ lens. Accurate $1/200$ shutter. Double-exposure prevention. Automatic shutter setting. Exposure counter. Price, \$33.50.



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Has it occurred to you how difficult it would be to prepare such a list *after* a fire? Many items would undoubtedly be forgotten until after your claim was paid and you signed a release!

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PLASTIC body "solder" is now available to the motorist for filling in small holes and dents on his car body or fenders prior to touching up with paint. The faulty surface is cleaned, roughed with sandpaper, and the solder applied with a knife. When dry, the filling is smoothed with a file or an abrasive to conform to the original curves, and the finishing material put on.—W. B.



Tires Put On in Winter Give Better Mileage

MOTORISTS have much to be gained by following the frequent practice of operators of large fleets of cars and trucks in replacing worn tires during the cold weather. Four thousand additional miles, it is claimed, can be gained from tires that are broken in during the winter months. Slush, snow, and ice do not wear down the tire treads nearly so fast as do hot, dry pavements, and by the time warm weather sets in, the rubber is thoroughly conditioned through use. It also is an advantage from the standpoint of safety to have good new nonskid treads on your tires for slippery winter driving, when there is enough danger of skidding even under the very best of conditions.—R. S. T.



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Three Hundred Ways to Solve the Problem of What to Make Next

WHAT shall I make next? That's a question that occurs over and over again in every home workshop. We suggest that you choose some of the projects listed below, or else send for our latest blueprint list, which contains more than 300 items.

Are you going to be near water next summer? If so, now is the time to start building a boat. Or perhaps you would like to construct a piece of furniture, or a radio, or a toy for the children, or a ship model. A few of our more popular projects are in this list. All of them have been illustrated in the magazine and, for the benefit of readers who would like to look up those pictures, a reference to the date and page of issue is given in parentheses after each item.

FURNITURE

Early American End Table (Dec. '38, p. 180), 361A	.25
Filing Case, table height of 30" (Feb. '39, p. 172), 365A	.25
Magazine Rack and Wastebasket to Match (Dec. '36, p. 75), 296A	.25
Maple Tavern or Long Table, colonial; top is 30" by 68" (May '37, p. 80), 318A	.50
Modern Tea Wagon and Cabinet into Which It Rolls (Apr. '37, p. 83), 313A	.25
Queen Anne Dressing Table, Stool, and Mirror (Dec. '36, p. 74), 295A	.75
Six-Footed Coffee Table, 14" high; top is 14" by 26" (Sept. '37, p. 103), 327A	.25
Small Early Colonial Pine Chest, 32" long, 21" deep, 24" high (Mar. '37, p. 87), 308A	.25
Softwood Coffee Table (Nov. '37, p. 97), 332A	.25
Special Bookcase for holding forty-eight issues of Popular Science Monthly (Oct. '38, p. 216), 353A	.25

MODELS

Clipper Ship GREAT REPUBLIC, 31½" hull (Dec. '35, p. 59), 272-273-274-R	1.25
Clipper Ship SEA WITCH, 9½" hull (Dec. '33, p. 66), 219	.25

(Continued on page 218)

Six Tools in One!

This latest model Delta 11" Drill Press is almost a complete workshop in one tool. It will, of course, perform all metal drilling usually required around your home shop, taking drills up to $17/32$ " in diameter. It takes all standard wood bits up to $1/2$ " shanks and can be used for drilling holes up to 2" in diameter with multi-spur bits. With the addition of special Delta attachments it can be used efficiently: for making square end mortises from $1/4$ " to $1/2$ " width and of any length—for numerous routing operations—for shaping—for sanding both curved and straight work—and for many jobs of surface grinding. No wonder this quality tool offered at a surprisingly low price is being used and endorsed in thousands of home shops and small industrial plants all over the country!

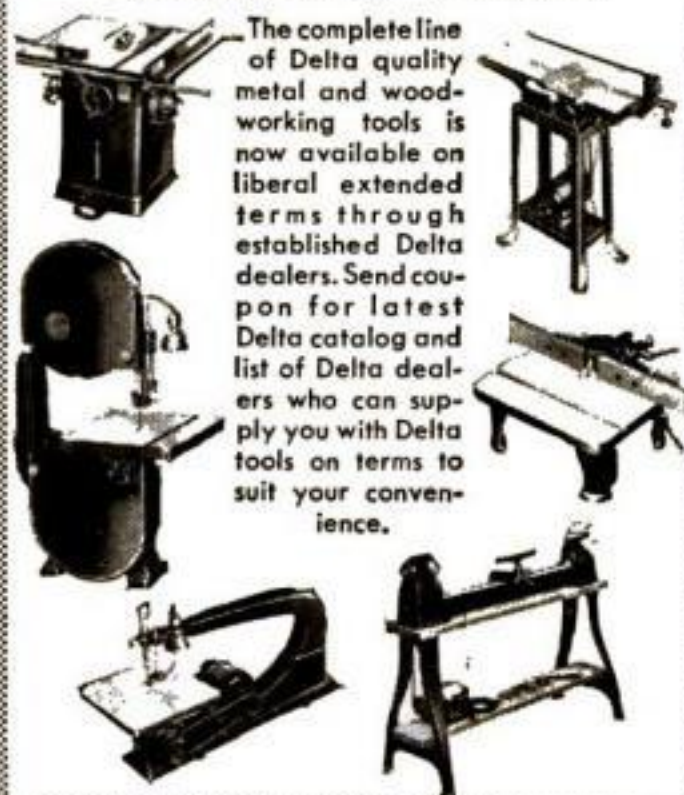
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Tested Workshop Plans

(Continued from page 216)

Coast Guard Patrol Boat of 165' Type, 20 $\frac{3}{4}$ " hull (July '36, p. 55), 286-287-R.....	.75
Confederate Raider ALABAMA, 21 $\frac{1}{2}$ " hull (Feb. '38, p. 77), 335-336-337-R.....	1.50
Elizabethan Galleon REVENGE, 21" hull (Apr. '33, p. 65), 206-207-208-209.....	1.00
Farragut's Flagship HARTFORD, 33 $\frac{1}{2}$ " hull (Jan. '34, p. 57), 221-222-R.....	1.50
Fishing Schooner WE'RE HERE of "Captains Courageous," 7 $\frac{1}{2}$ " hull (Oct. '38, p. 172), 351-R.....	.50
Harbor Tugboat and Barge, miniature water-line models 5 $\frac{3}{16}$ " and 7 $\frac{3}{16}$ " long respectively (June '36, p. 74), 285.....	.25
H.M.S. BOUNTY, 8 $\frac{1}{2}$ " hull (Apr. '35, p. 68), 254.....	.25
Liner NORMANDIE, 20 $\frac{1}{2}$ " hull (Oct. '35, p. 57), 261-265.....	.50
Liner QUEEN MARY, 10 $\frac{1}{4}$ " hull (May '36, p. 74), 283.....	.25
Liner PRESIDENT LINCOLN, 14 $\frac{3}{4}$ " long (Aug. '37, p. 88), 325.....	.25
New Bedford Whaleboat, with complete equipment, 14" hull (Sept. '37, p. 104), 326-R.....	.50
Ocean Freighter, 14" hull (Oct. '35, p. 57), 271.....	.25
Old Naval Cannon, a six-pounder in battery, period about 1798; gun is 7 $\frac{3}{8}$ " long, model over all is 9" by 11 $\frac{1}{2}$ " (Nov. '38, p. 170), 352.....	.25
Privateer SWALLOW, a Baltimore clipper, 13" hull (Nov. '34, p. 65), 228-229-230-R.....	1.00
Revenue Marine Cutter of 1850 JOE LANE, 21" over all (Nov. '39, p. 174), 374.....	.75
Trading Schooner, three-masted, 17 $\frac{1}{2}$ " hull (Mar. '35, p. 68), 252-253.....	.50
Yacht NOURMAHAL, 8 $\frac{1}{8}$ " hull (Jan. '36, p. 61), 276.....	.25

BOATS

Cabin Cruiser, 17' long, weighs 750 lb., for use with inboard or outboard motor from 2 to 10 h.p. (Feb. '39, p. 161), 356-357-358-359-R.....	1.50
Fisherman's Outboard Boat, 9' 3" or 11' 6" long, weighs 115 or 160 lb., for motors from 3 to 16 h.p.; can also be rowed (July '38, p. 55), 344-345-R.....	.75
Racing Runabout, 13' stepless hydroplane for outboard motor, weighs 275 lb. (June '35, p. 60), 261-262-R.....	.75
Racing Sailboat BLACKCAT, 13' 4" long, weighs 250 lb., Marconi rigged (July '37, p. 71), 321-322-323-R.....	1.00
Sport Runabout, 9' 8" long, weighs 100 lb., for small outboard motors (Apr. '37, p. 71), 309-310-R.....	.75
Utility Rowboat, 13' long, weighs 175 lb.; can also be sailed or driven by outboard motor (Aug. '34, p. 84), 224-R.....	.50

MISCELLANEOUS

Bed or Armchair Table (Dec. '37, p. 85), 333A.....	.25
Beginner's Battery Radio (Feb. '39, p. 223), 365A.....	.25
Bicycle Trailer (Apr. '39, p. 161), 367A.....	.25
Cigarette Holder, designed in form of miniature three-gun naval turret (Feb. '37, p. 91), 299A.....	.25
Mexican Patio Furniture for Dolls—covered-wagon couch, roll-around couch, table, and cart (Dec. '38, p. 164), 354A-355A.....	.75
Photographic Split-Image Range Finder (June '39, p. 168), 369A.....	.25
Rowboat Back Rest (July '38, p. 73), 347A.....	.25
Turned and Inlaid Bowl and Candlesticks (Feb. '37, p. 79), 307A.....	.25

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A 45-deg. chamfer, rather than a radius, is preferable in connection with drill bushings.

A good job of multiple-cylinder bore grinding can be done in a horizontal boring mill, providing that the bore-to-bore adjustments are made by a sliding movement against a parallel bar. Concentricity of each bore should be determined by replacing the grinding wheel with a disk plug of the same diameter as the bores before being ground.

Adjacent parts to any section being welded can be protected by a heat-resisting compound now available.

There are supposed to be sixteen general types of arc-welded joints. Consider yourself a good welder if you can name eight and weld them correctly.

It is sometimes necessary to weld forming-die sections with bare wire electrodes to fill shallow grooves made by the slip of the tool. This operation will pull the carbon from the tool steel to harden the spot sufficiently if the work is quenched in water when the welding is completed.

A machine shop can only get the same number of identical tools from 544 lb. of high-speed steel as from 490 lb. of tool steel. There is that much difference in the weight per cubic foot. This is another reason to trim to the bone all machining allowances for high-speed steel.

Service tags and holders such as are used on automobiles are desirable on all welding machines. Any repairs, oilings, and cleanings should be recorded with the dates. The cleaning should consist of blowing out dust with an air hose, then wiping off brushes and moving parts with clean rags, and last but not least, oiling.

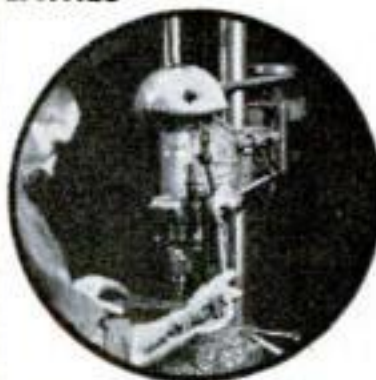
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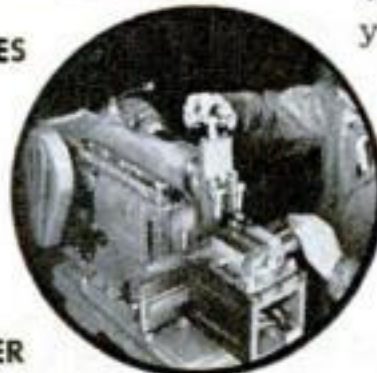
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(Continued on page 221)

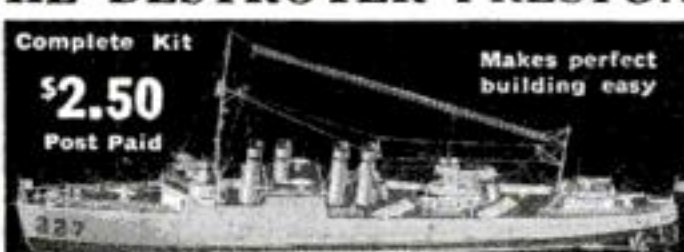
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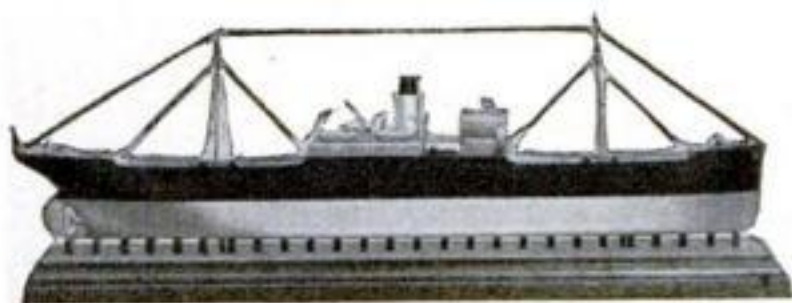
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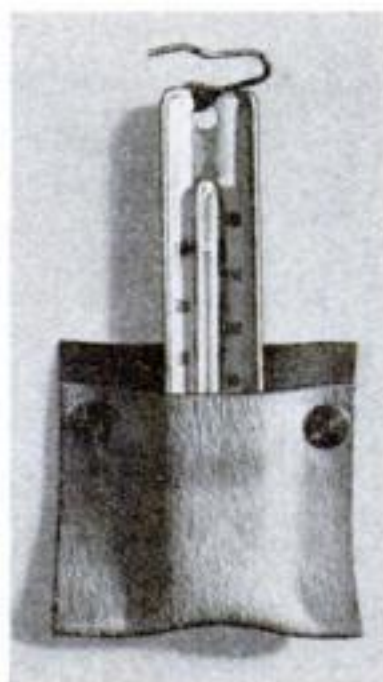
Timer Made by Adding Extra Hand to Clock

AN OLD alarm clock can be adapted for timing developing solutions by adding an arrow-shaped tin hand outside the glass as shown. Cold solder is spread in the center of the glass and a small nut is pressed gently



into the cement. When the cement has hardened, the tin arrow is mounted by means of a small bolt. In use, the arrow is moved the desired number of minutes ahead of the minute hand; and when the minute hand catches up, development is complete.

Rubber Pocket Safeguards Darkroom Thermometer



A **DARKROOM** thermometer is not likely to become lost or broken if it is kept in a wall pocket made from an oblong piece of old inner-tube rubber. Fold it over as shown and cement the edges. Attach the pocket with a couple of thumb tacks to a convenient spot on the darkroom wall.

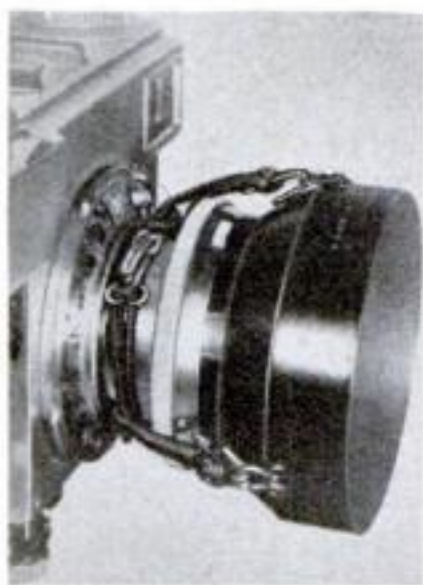
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A Portable Rack for Drying Negatives

MORE negatives can be hung in a smaller space on the portable negative drying rack illustrated above. Window hooks, obtainable at large stationery stores, are used for the negative clips. The upper curved portion is flattened out and cut off about 1" from the clip. Then a hole is made in each, and the clips are threaded on a solid copper wire, where they are spot soldered at 2" intervals.—HOWARD HOADLEY.

Fastening Lens Shade to Miniature Camera



WHEN working in crowds or with heavy filters, there is always some danger of losing a slip-on lens shade from a miniature camera. If the camera is of the type having an enlarged end on the lens, narrow loops of black elastic will hold the shade

securely. One loop fits around the lens barrel and is held with a hook and eye. First, however, it is threaded through three other short loops, each of which ends in a hook. These hooks engage three eyes soldered at equal distances apart on the outside of the lens shade.—E. D. GODBOLD.

Diluting Stock Developers

ACCORDING to photographic authorities, stock developing solutions should not be diluted with plain water, as the air dissolved in the water tends to oxidize the developer. Instead of water, a dilute solution of sodium sulphite is preferred—about 1¼ oz. sulphite to 2 qt. water. The sulphite has a great affinity for oxygen and delays deterioration of the developer by acting as a preservative.—K. S.



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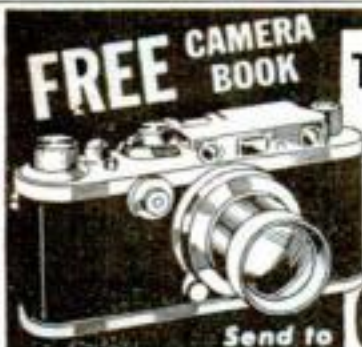


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Photographing a Tunnel

(Continued from page 79)

fessional movie makers scoffed when he told them of his plans, but he completed putting the 175-pound outfit together and soon was taking pictures. "With the amplifier sitting between the tripod legs and the pre-amplifier before my eyes," he says, "all I have to do is focus the camera, keep the picture framed, make sure the lights are adequate, watch the camera speed, and keep the gain control at the proper level." So simple!

Fox also confounded the critics who declared he could take only restricted scenes, owing to the absence of lighting facilities. For "push shots," or moving scenes, he built a mobile jumbo, or platform on wheels, which was attached behind a battery-driven locomotive. On the floor he placed two 125-volt locomotive batteries, and to these attached seven 2,500-watt incandescent lamps. To obtain depth of lighting near a tunnel end, miners clinging to supports held additional lights.

One of the most spectacular picture records shows two workers carrying a heavy board through falling water in San Jacinto Tunnel. Rain fell through the roof, streams squirted in from the sides and welled up through the floor—28,000 gallons a minute. A metal shield and an umbrella covered both movie and still cameras for this picture, while special glass made to resist both heat and water shielded the lights. Fox placed the lights beyond the falling rain, thus backlighting his "set," and obtained the very unusual picture of men working in a downpour 3,000 feet underground.

How many times Fox has crossed the state of California from one end of the line to the other in quest of new pictures, he cannot guess. He knows the aqueduct more intimately than any other man. From the top of drag-line booms, 100 feet in the air, he has caught giant crawling machines gnawing wide ditches in the desert.

Fox wearied of water under the mountains and desert many months ago. But he's not completely cured. Between his garage and bungalow on the outskirts of Banning, Calif., nearly 100 miles from the Pacific Ocean, I saw a seagoing ketch in the making. His wife and Bill, Jr., were busy calking the bottom. Bill, Sr., gazed fondly at the craft. "Another year or two," he said wistfully, "and we'll drop her in the water. There are bunks for three, and an auxiliary engine will keep us moving through a calm. Now, let's see—where shall I stow the cameras?"

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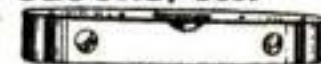
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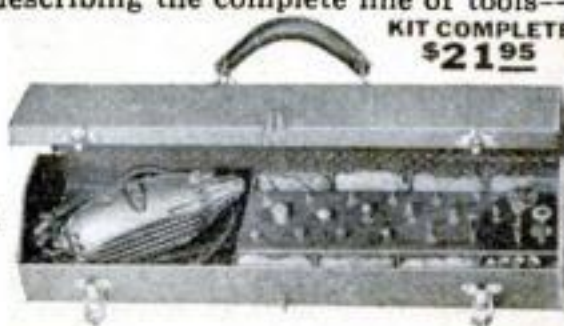
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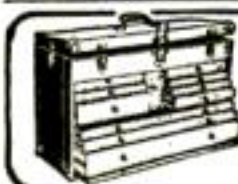


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The Making of an Army Flyer

(Continued from page 64)

nose rose above the horizon. Majestically the plane lifted, swung toward the right, and the right wing dipped gradually in a vertical bank.

"Halfway point. From here the maneuver is the exact opposite of the first part."

The plane began to straighten out and the horizon tilted back, the motor's roar lessened, and in another moment they were in level flight, now headed back toward the starting point.

Cadet Jones grasped the idea and his efforts did him credit, though once when he felt the ship hesitate in its upward spiral and threaten to stall, he opened the throttle with a rush. At a quick shake of the instructor's head, he quickly smothered it down. Soon he was allowed to practice the maneuver solo.

Returning homeward alone, he noticed another PT-13 approaching at his left, flying very low—well under the 500-foot minimum altitude prescribed for approaching the field. As Rick swung right to follow the imaginary lane of the "traffic pattern" for incoming and outgoing ships, the other plane disappeared, blanketed from sight behind the wings.

Cadet Jones began to worry. Where would this erratic flyer come out? Would he go downward, or zoom suddenly from below and tangle with Rick's machine?

Instead of nosing down to land, Rick gunned the motor, flew up the field, made a square circuit at 500 feet, headed up the runway, and landed near his own hangar. The other pilot now was bumping unsteadily across the field on the wrong side.

As he walked into the flight office, helmet and goggles in hand, the flight commander, who never had shown any indication of noticing Rick at all, looked up from his desk.

"Cadet Jones, you used good judgment in going around the field instead of landing blind and trusting to luck. The Army likes pilots who use their heads!"

TWELVE weeks had passed so quickly that it seemed only yesterday that Rick Jones had walked in the front door of the primary training school, a mere civilian, ignorant of lazy 8's and echelons, of leading edges and burble points, of high-pressure areas, great-circle distances, and trajectories. Now the long glass-fronted shops, the enormous barnlike hangars, seemed like home and he hated to leave.

But now he was a "dodo" no longer—and

(Continued on page 232)

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The Making of an Army Flyer

(Continued from page 230)

ahead lay greater adventures: America's largest flying school, a city of 4,000, devoted entirely to the training of flying officers. For every cadet who came to this great university of the air to study, five men worked behind the scenes to keep the machinery of the immense plant running perfectly.

When the train pulled in, the station wagon was waiting. Rick achieved a snappy salute for the khaki-clad orderly who greeted the half dozen cadets for Randolph Field.

The tiled tower of the Administration Building glinted in the blazing Texas sun. Overhead droned a dozen blue-and-yellow monoplanes. A prodigious roar rolled forth from a long roofed stall where coveralled cadets tinkered with motors racing in the test blocks.

In the office, Rick reported to the commandant of cadets, was assigned to a room in one of the big tile-and-stucco barracks, and met his roommate, a breezy, red-haired young Irishman named Ryan. After evening mess, the two strolled over to the row of hangars along the north flying field. Through an open door they glimpsed a double line of sleek, low-winged monoplanes, new and shining with their glossy yellow wings and blue fuselages.

The two stepped inside for a closer look. Rick ran his eyes eagerly over the trim ship, with its 400-horsepower engine, its two-position "prop," its "eyebrow" slots, its landing flaps, its wing-tip lights.

"Thirty thousand dollars worth of modern fighting plane," said Ryan. "Two-way radio and everything. They tell me this crate really gets up and steps—flying it is going to be like riding a motor cycle instead of a kiddie car!"

Rick climbed onto the wing step and peered into the rear cockpit. Compared with the simple instrument board of the PT-13, the panel fairly bristled with mysterious gadgets—knobs, dials, levers, and buttons.

"And where are you going to fly her now?" demanded a strange voice. A tall soldier with peaked garrison cap and blue arm band stood with hands on hips.

"One of the new bunch, eh? Well, don't try to take this ship to bed with you. I'm on M.P. duty in this area and we simply don't allow it. You'll be getting your hands full of BT-9 during the next twelve weeks."

Next month Sterling Gleason will tell more of Rick Jones's adventures as a flying cadet in the Air Corps.

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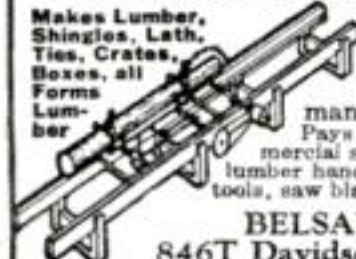
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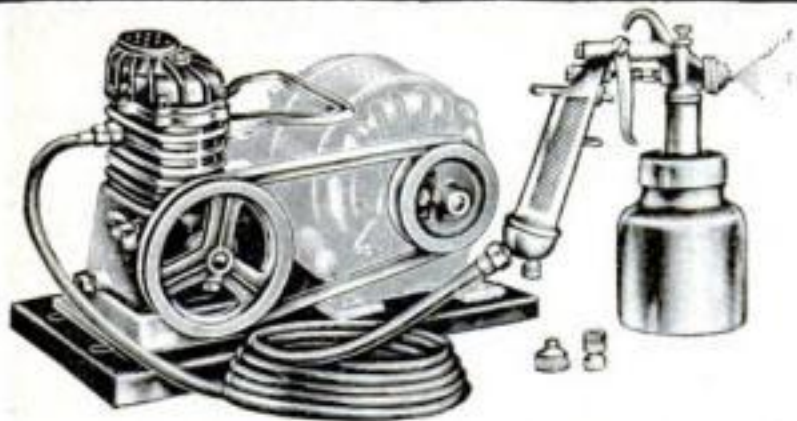
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Stunts for Home Chemists

(Continued from page 203)

should be made up, as in the earlier experiment cited above. For solution No. 1, dissolve a quarter teaspoonful of sodium hydroxide (lye) or of potassium hydroxide in 500 cubic centimeters (about a pint) of water. Then add a piece of luminol as large as a pea and shake until dissolved. For solution No. 2, dissolve several pea-size crystals of potassium ferricyanide (also called red prussiate of potash) in 500 cubic centimeters of water. Also add to this solution a teaspoonful of hydrogen peroxide of ordinary drug-store strength (a three-percent solution).

Mix small quantities of solution No. 1 and solution No. 2, in a darkened room, and the mixture will glow with a characteristic blue light. Printed matter may plainly be read by the soft, weird illumination.

For the new color effects, set up five beakers, tumblers, or conical beer glasses. (These should be given the most thorough washing afterward, if borrowed from household service.) Using a spatula, place a little anthracene in the first vessel; fluorescein powder in the second; erythrosin (aniline red) in the third; eosin in the fourth; and uranin in the fifth. Only a pinch or so of each chemical is needed. The last four are dyes, and may be obtained from dealers in chemicals or microscope supplies.

Half fill each vessel with solution No. 1 (the alkaline luminol solution). Darken the room. Now finish filling each vessel with solution No. 2 (peroxide-ferricyanide).

At once the liquids glow as if with colored fire. The anthracene changes the blue color of the glowing luminol to greenish blue. Fluorescein makes the solution shine with a rich, deep gold color. Aniline red produces a purple glow. Eosin imparts an orange hue, and uranin gives a tint of brilliant gold.

POPULAR SCIENCE Question Bee

HERE are the correct answers to the Question Bee on page 130. Give yourself five points for each one you had right. A total of 75 to 85 is good; 90 or more is excellent.

- | | | | | |
|------|------|-------|-------|-------|
| 1. d | 5. b | 9. c | 13. b | 17. b |
| 2. b | 6. b | 10. d | 14. b | 18. c |
| 3. c | 7. d | 11. a | 15. c | 19. c |
| 4. b | 8. c | 12. b | 16. b | 20. f |

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Taps should be taken from the resistance wire and led to a switch, the number of taps depending on what is required. Only a part of the heater coil need be used, the amount depending on the voltage of the transformer and the size of the wire. A little experimentation will show the right amount of wire to use.—ARTHUR L. D. FORD.

Rust Improves Appearance of Model Railway Track

SCALE model railway tracks, if of steel, look much more realistic when the rails are rusty, as the real thing always is. The rail should be wiped with a cloth dampened with soldering acid (15 percent muriatic acid), preferably before the tracks are laid. The rust will appear in a day or two. When sufficient has accumulated, wash the rail in a solution of baking soda and water; and after this has dried, wipe it with an oily rag to darken the appearance and prevent further rusting.

The running surface should be bright, so after the rail is laid, rub the top of the tracks with emery cloth wrapped around a block of wood; then go over it with an oily rag to keep it bright.

Roundhead Brass Screws Support Third Rail on Model Layout

FOR O-gauge scale model railways, an inexpensive third rail may be made from No. 10 hard brass wire soldered to the heads of 5/8" No. 5 roundhead brass screws. Brass strip, either square or rectangular, is even better than wire. In O-gauge, the third rail is placed 1/8" higher than the running rail and is centered so as to be 11/16" out from the gauge line.

Code for Locomotive Whistle

WHEN your model locomotive approaches a grade crossing, give two long and two short blasts. To apply brakes, the signal is one short whistle; to release brakes, two long; for flagman to protect rear, one long, three short; for flagman to return, four long.

Christmas With Your Microscope

(Continued from page 200)

and similar objects is with the metal plate described for textile fibers. Thread one or, if necessary for a tight fit, two or more needles through one of the holes in the plate, and with a razor trim the specimen flush with both surfaces. With a pencil eraser, push the remaining piece until it sticks above one surface a little, and shave it off with a wet razor blade. In this way you can cut very thin, uniform sections. For temporary mounting, put them in a drop of water under a cover glass.

In examining the leaf, you find it has a definite structure. First the relatively thick skin or epidermis. Keep this thickness in mind. Then, next to it, the sclerenchyma or rigid tissue. Next, a band of green cells with resin ducts scattered among them, the ducts being large and open at the center. Then, in the center of the needle, an assortment of empty cells, with a pair of fibrovascular bundles, one near the center of each half of the area. And if you happened to slice a stoma or breathing pore, you can see the two large guard cells that flank it.

Examine the outside surface of a Christmas-tree needle at moderate power, and you will see that it possesses a number of oval devices arranged in rows. These are the stomata through which the leaf breathes, as seen from a different angle.

Now do you sense a situation that will explain much of this construction? Well—it's a matter of moisture. If you have seen pine trees and other evergreens growing wild, you know that many of them perch on steep slopes, on hill tops, and in other places where moisture is not abundant. Probably the majority of evergreens grow in such places, for the leaf shape, position, its tough skin, its breathing pores, and almost every other detail point to an effort to restrict and control the evaporation of moisture from its surface. Now you know one reason why Christmas trees have needles instead of leaves!

There are numerous other details of the yuletide evergreen that you can study with your microscope, details that cannot be covered here, except very hastily. With a sharp razor, either the straight type or a safety blade in a suitable handle, and a piece of cardboard, cork, or soft wood for a "chopping block," cut some thin sections from a stem taken from the tree. Make several cross sections, and several radial or tangential sections. The first are produced by cut-

(Continued on page 239)

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Abstract

254

THIS ONE



Christmas With Your Microscope

(Continued from page 237)

ting squarely across the stem, the others by shaving the stem lengthwise. Select the thinnest pieces, and put them on a slide. Examine them dry and in water. If you want to keep them several days, use a drop of glycerin instead of water.

The cross sections will show you a typical stem structure—the outer bark, bast cells, cambium layer, wood cells, and in the center the pith cells. The large resin ducts are seen in the outer bark and in the wood; and the medullary rays, the crosswise carriers of water, are seen as streaks radiating from the center outward.

In the tangential or radial sections obtained by slicing lengthwise, you can see the medullary rays in cross and tangential section, and obtain a lengthwise view of the other important cells.

When your Christmas tree dries up and is ready for the ash can, saw a piece from the trunk near the base, and cut cross and longitudinal sections of the wood for examination with your microscope. You can do this, when the wood is dry, with a plane having a very sharp bit. Take the thinnest shaving you can, and mount the sections dry and in water or glycerin for examination. In the central, woody part of the cross section you will see the tracheid cells grouped together to form a lacelike network. Look closely and you will observe that the cells are arranged in circular or curving bands, each band consisting of large, thin-walled cells at one boundary that give way gradually to small, thick-walled cells at the other boundary. Here, again, you see the effect of moisture, for the large cells are the ones that grew in the spring and early summer when moisture was scarce. Here and there you will see the resin ducts with their large, open centers.

The tangential or radial sections (longitudinal slices) of pine wood show, among other details, the bordered pits or automatic valves in the tracheid cells. These look much like tiny washers placed edge to edge. When the cells were carrying moisture, the bordered pits served as valves through which the moisture passed from one cell to another. Note that, where one tracheid ends and another begins, their ends are tapered so the water could pass easily from one to the other, through the valves.

If you want to observe still more details of your Christmas tree, get hold of a good botany textbook and read about other fascinating features of this popular tree.

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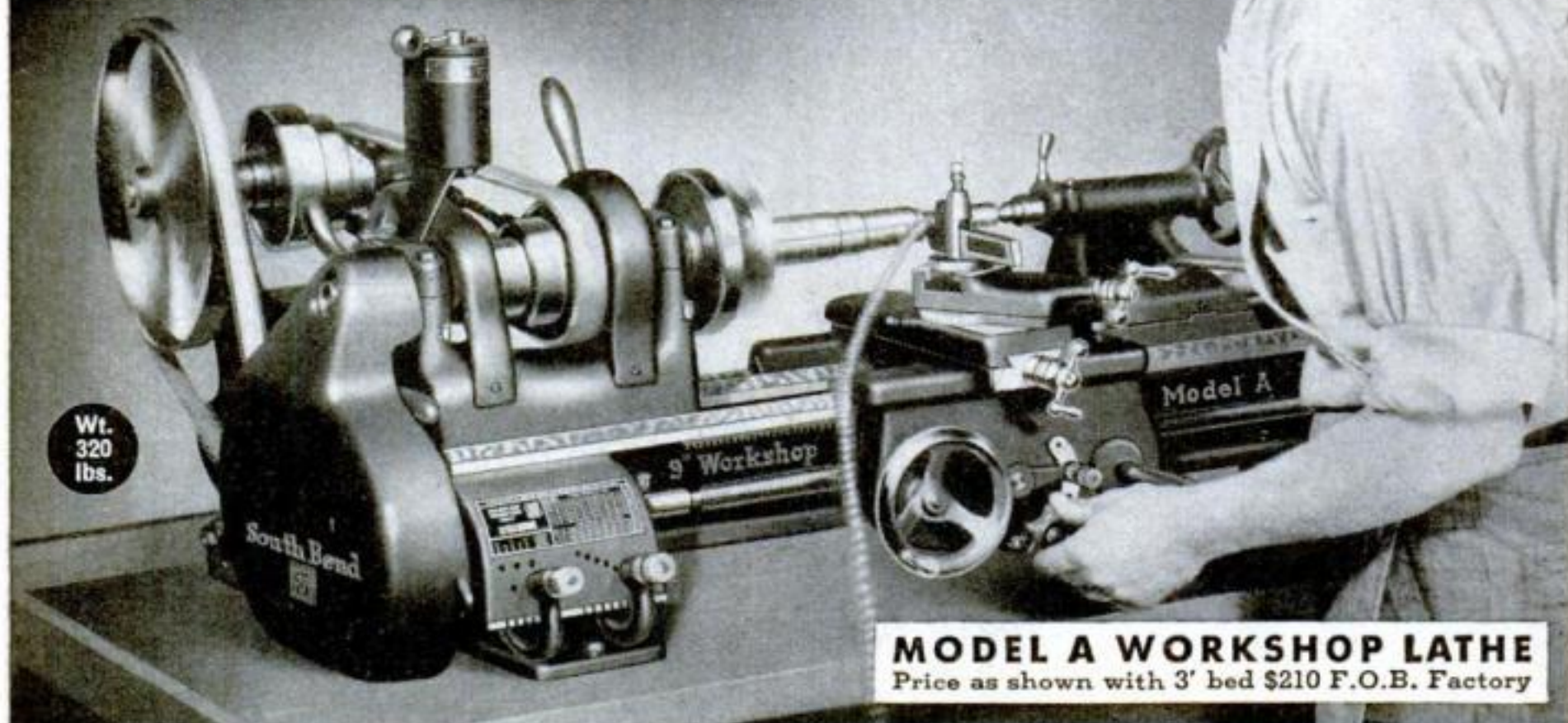
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